JANUARY 1985 VOL. 3, NO. 1 $3.95

FOR IBM PERSONAL COMPUTER USERS

TECH JOURNAL

TAKE III

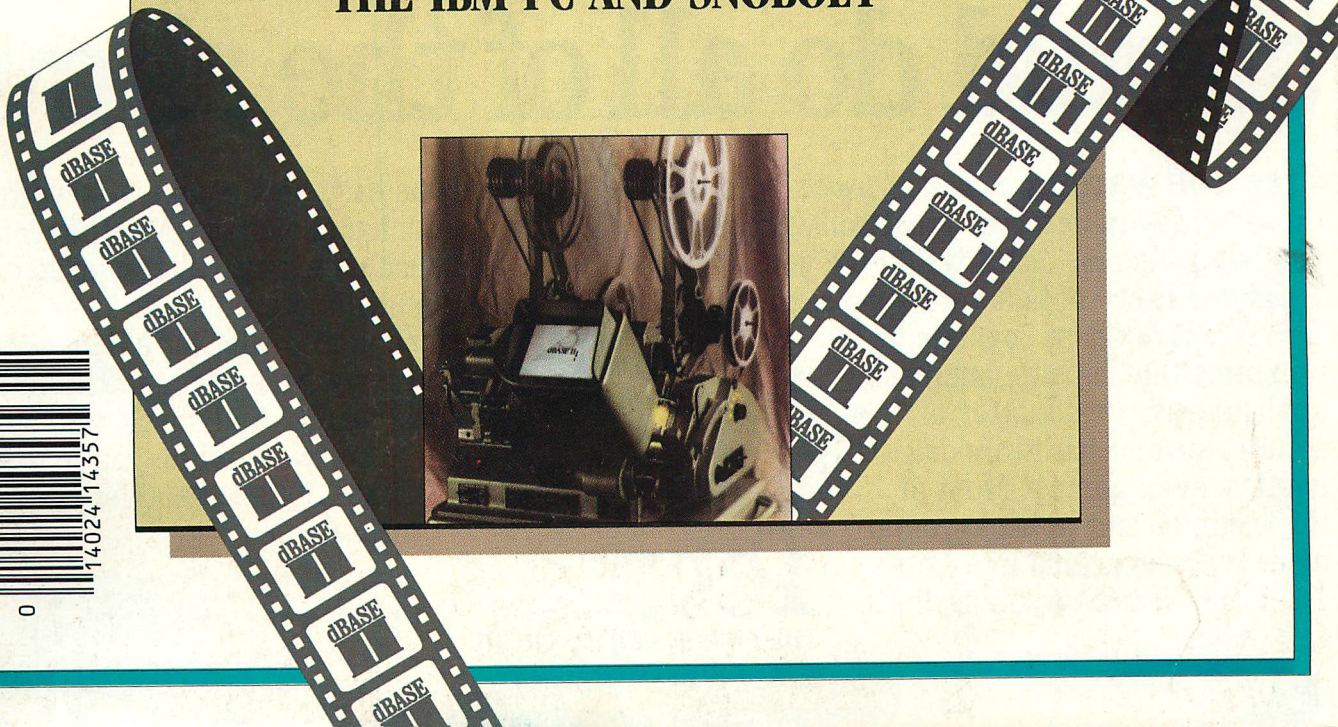
Converting dBASE II applications to dBASE III

19 DEBUGGERS FOR THE IBM PC

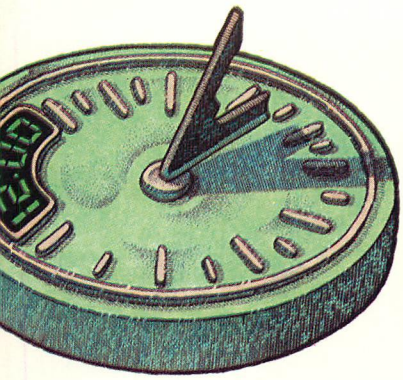
SMD CONNECTIVITY WITH MAVERICK

THE KERMIT FILE-TRANSFER PROTOCOL AND ITS TELIOS IMPLEMENTATION

THE IBM PC AND SNOBOL4

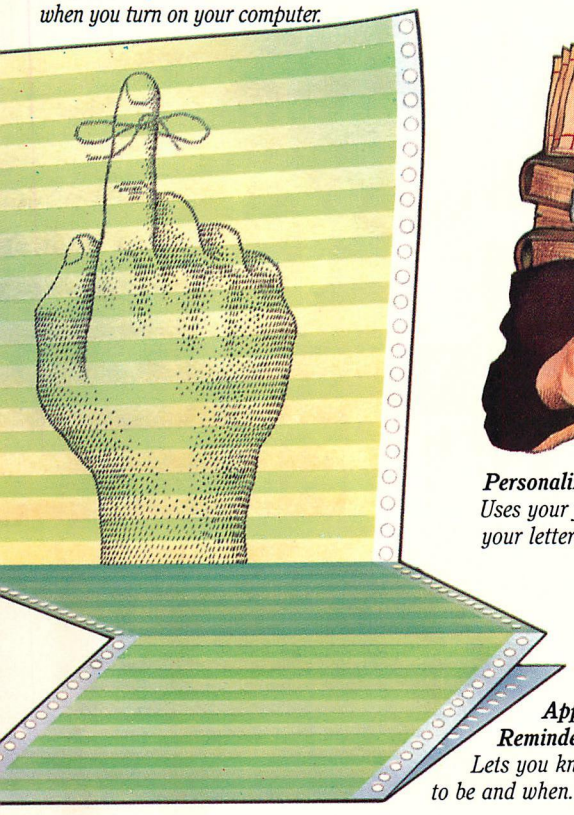


0 14024 14357 01

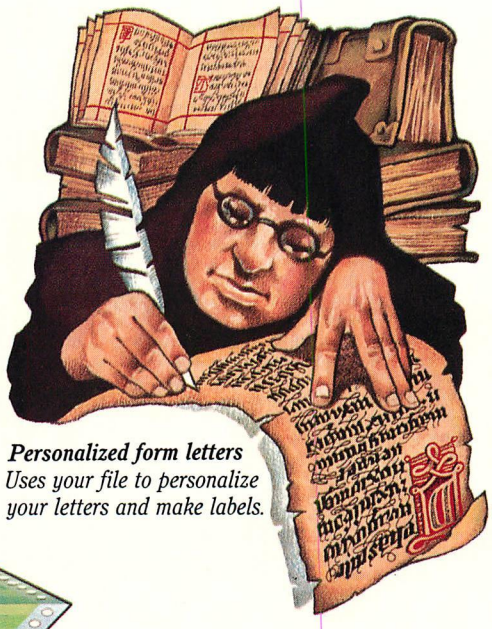


Clock/Calendar
Automatically inserts the date and time when you turn on your computer.

Encode/Decode
Ensures the security of your files.

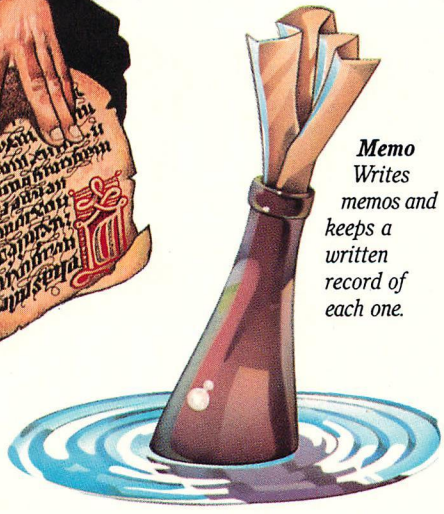


Appointment Reminder
Lets you know where to be and when.



Personalized form letters
Uses your file to personalize your letters and make labels.

Calculator
Does your figuring in background mode so you won't have to change programs.



Memo
Writes memos and keeps a written record of each one.

Tecmar thinks your PC

As your business grows, so should your computer. Only Tecmar offers you this unique package of hardware and free software. With it your PC can grow to its full potential.

Tecmar Multifunction Boards...

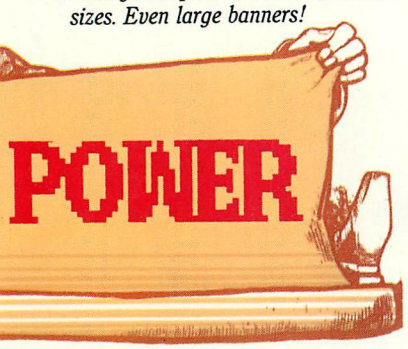
"extremely powerful."—PC World

A Tecmar board will expand your computer's memory and increase its speed and efficiency. It will give you additional ports to accommodate a wide range of peripherals from modems and plotters to dot matrix and letter quality printers.

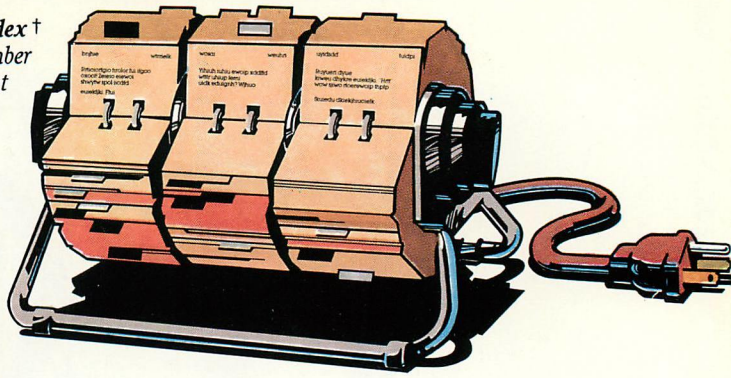
With a Tecmar board you can run powerful programs like Lotus 1-2-3™* and WordStar®†† on a PCjr. The RamSpooler makes printing a background task and frees your PC for other jobs. A built-in clock/calendar automatically inserts the date and time at power on and is independently powered by an easily replaced battery.

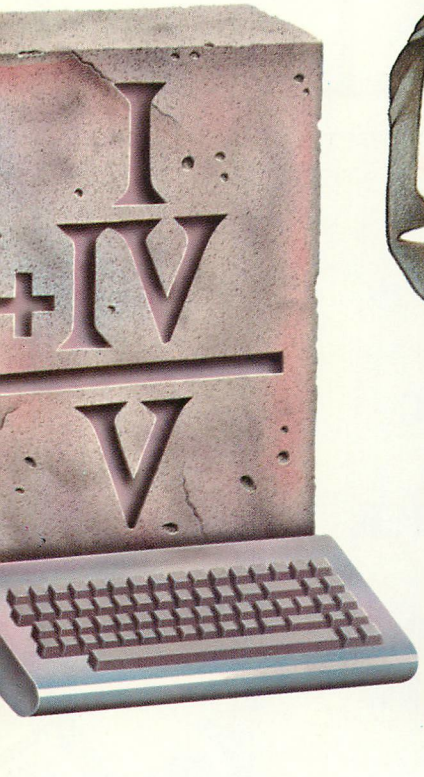
Every Tecmar multifunction board is run through a series of rigorous tests to ensure quality. Our incredibly low failure rate (0.4%) is unparalleled. All boards are additionally backed by a full one-year warranty.

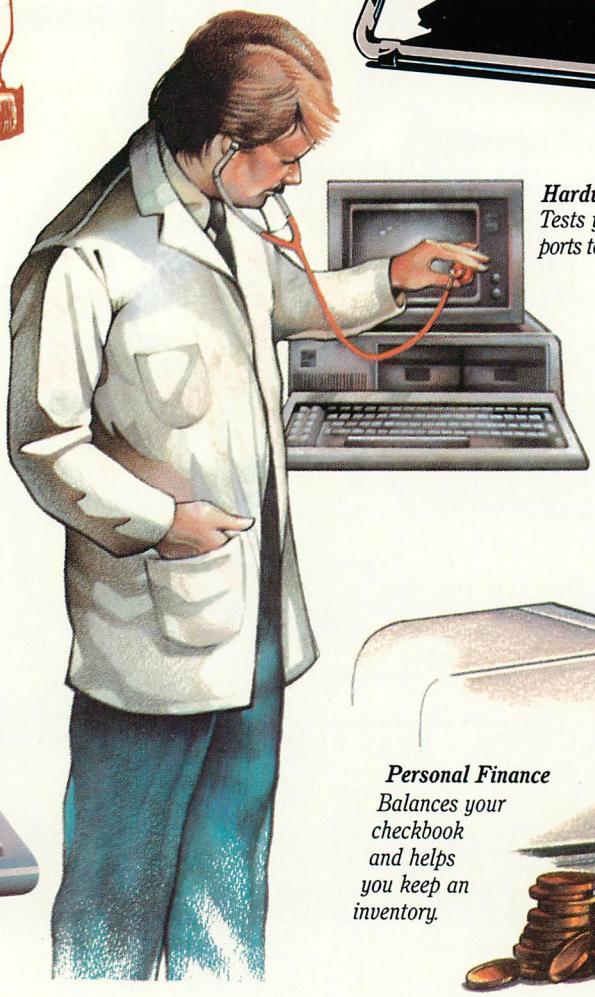
Banner
Allows you to print in a variety of type sizes. Even large banners!



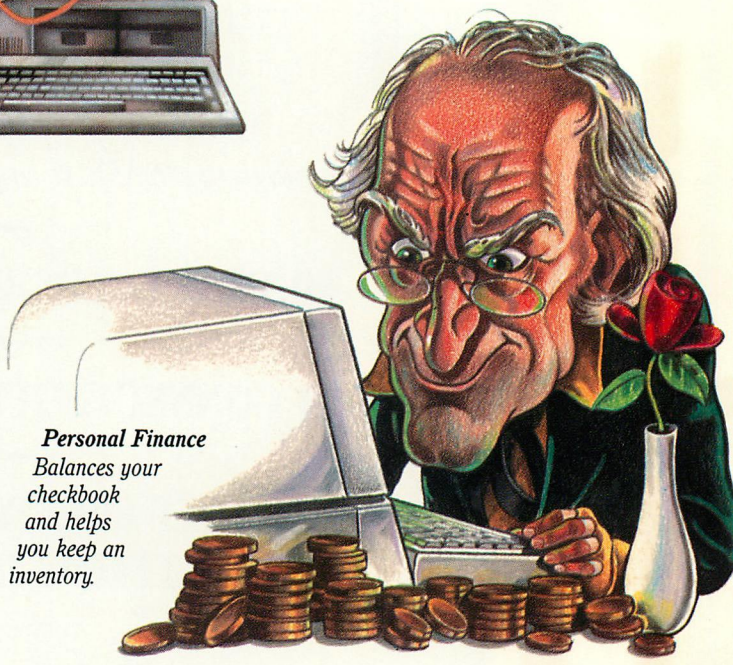
Rolodex†
Finds the name and number you need instantly without changing programs.







Hardware Diagnostics
Tests your PC's memory and parallel ports to stop problems before they happen.

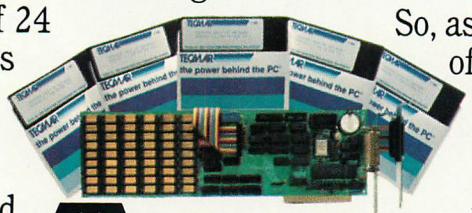


Personal Finance
Balances your checkbook and helps you keep an inventory.

should do all of the above.

Free Software *"...a chest of Jewels."—PC Week*
Great hardware deserves great software. So, if you buy a Tecmar board we'll give you our Treasure Chest™ of Software at no extra charge. The Treasure Chest consists of 24 programs that include business applications, a calculator, a security system, hardware diagnostics, even games! Most of these can be run in background mode with programs like Lotus 1-2-3 and WordStar. Using these features is as easy as a couple of keystrokes, and without changing disks. No other company offers you such an extensive array of software with their multifunction boards.

So, ask your dealer for a demonstration of any of Tecmar's multifunction boards. And check out the free software while you're there. Or call 216-349-0600 for the dealer nearest you.



Tecmar
THE POWER BEHIND THE PC

*Lotus 1-2-3 is a registered trademark of the Lotus Development Corporation.
†Rolodex is a registered trademark of the Rolodex Corporation. ††WordStar is a registered trademark of the MicroPro International Corporation.

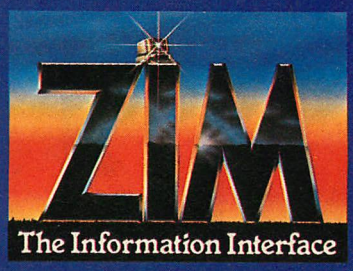
CIRCLE NO. 187 ON READER SERVICE CARD

The power behind your PC is right behind this page.

The multi-user data base management system that puts mainframe power in your micro.

ZIM is a fully integrated fourth generation application development language that is loaded with these features and more.

- POST RELATIONAL
  - — Entity Relationship Model
  - — Powerful extension of Relational Model
- REPORT WRITER
  - — Unlimited break levels, summary/ detail reports, output to disk, printer, terminals
- FORMS PAINTER AND MANAGER
  - — Menus, data entry, data display
  - — Box fields
  - — Old field value recall
- DATA DICTIONARY
- COMPILER • PROGRAMMING LANGUAGE
- APPLICATION COMPLEXITY SUBJECT ONLY TO HARDWARE LIMITATIONS
- UNLIMITED FILE RELATIONS
  - — One to one
  - — One to many
  - — Many to many
  - — Unrelated



- RETRIEVAL STRATEGY OPTIMIZER
  - — Automatic use of 8087 chip (if available)
- APPLICATIONS PORTABILITY
- MULTI-USER
  - — Full transaction processing control
- C LANGUAGE INTERFACE
- QUALITY PRODUCT SUPPORT

Zim is a mainframe data base management system that runs on micro-computers. If you want mainframe power, speed, flexibility and freedom from arbitrary limitations all at a micro price, talk to us about an evaluation system.

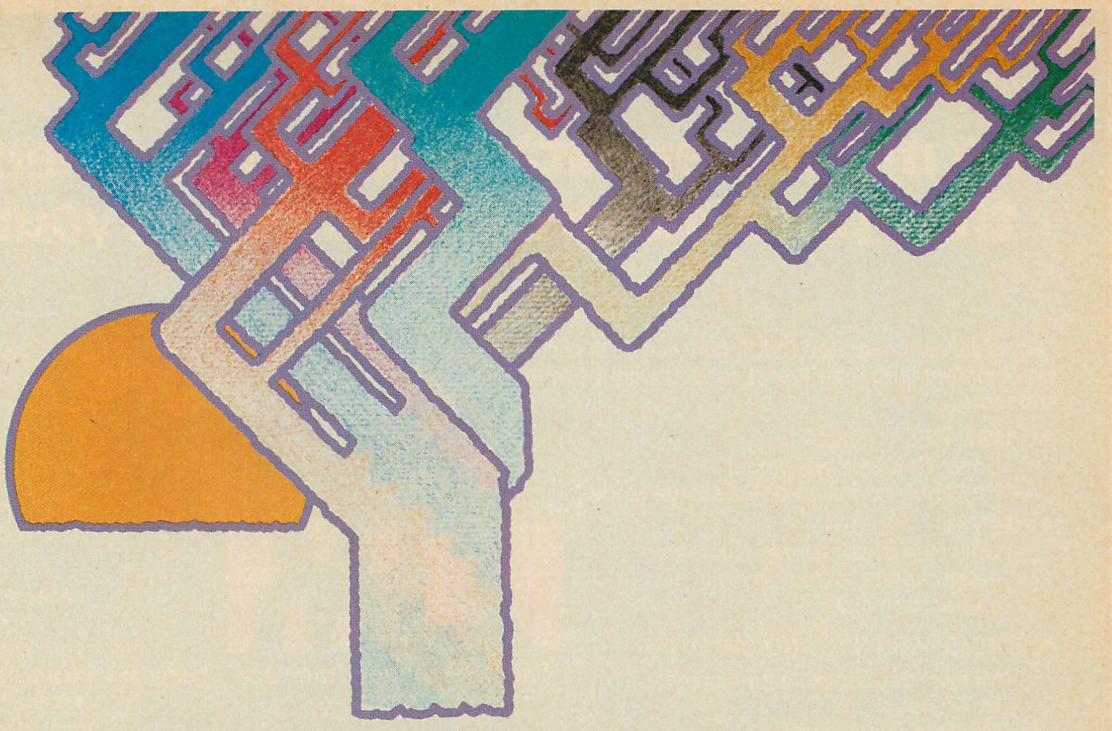
Dealer inquiries are welcome.

ZANTHE
INFORMATION INC.

1785 Woodward Drive
Ottawa, Ontario K2C 0R1
(613) 727-1397

OUR FEATURE STORY

CIRCLE NO. 148 ON READER SERVICE CARD



Btrieve and Xtrieve. B-tree file access for all your programming languages. With the query tool your users demand.

Introducing a powerful data base combination for PC application developers. Btrieve™, the most sophisticated file access method for your IBM™ PC. In single user and network versions. And Xtrieve™, a new menu-driven query tool that gives you—and your users—fast access to information.

Btrieve: for professional programmers. Btrieve provides fast, flexible file management for all your application development. All your programming languages—BASIC, Pascal, Cobol, C. With multikey access to records. Automatic file recovery. Unlimited records per file. Duplicate, modifiable, and segmented keys. Variable cache buffer.

Better applications faster. Based on the b-tree file indexing system, Btrieve provides optimal file management and eliminates writing file management routines. So you can develop *better* applications *faster.*

Xtrieve: easy window interface. The ideal complement to Btrieve, Xtrieve is the non-programmer's interface. Xtrieve's full relational capabilities let users define a virtual table of data from multiple files. Then Xtrieve speeds them through query building with a series of easy-to-follow windows.

No command language. Xtrieve is completely menu-driven, so there's no need to memorize command language. Or special syntax. Everything you need is on the screen. You and your users can perform unlimited queries—and get answers fast.

Xtrieve features a full range of restriction criteria. Online help messages. Automatic maintenance of information order by multiple indexes. And interfaces to access information from Lotus 1-2-3™ and dBase II® files.

Network capabilities. Network versions of Btrieve and Xtrieve allow data sharing in the most popular PC networks — PCnet™, NetWare™, EtherSeries™, MultiLink™, and OmniNet™.

For more information or to order, call or write:

SoftCraft Inc.

P. O. Box 9802 #590 Austin, Texas 78766 (512) 346-8380

Suggested retail prices: Btrieve, $245; Xtrieve, $195. Btrieve/N (network), $595; Xtrieve/N, $395. Dealer inquiries welcome. Btrieve requires PC-DOS or MS™-DOS 1.X or 2.X; Xtrieve, PC-DOS or MS-DOS 2.X.

Btrieve and Xtrieve, IBM, 1-2-3, dBase II, PCnet, NetWare, EtherSeries, MultiLink, OmniNet, and MS are trademarks of SoftCraft Inc., International Business Machines, Lotus Development Corp., Ashton-Tate, Orchid Technology, Novell Data Systems, 3Com Corp., Davong Systems Inc., Corvus Systems, and MicroSoft Inc.

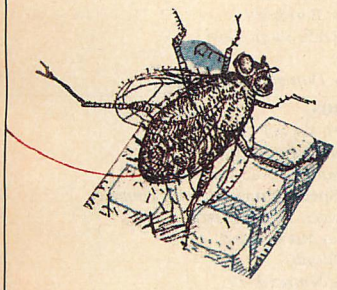
CIRCLE NO. 201 ON READER SERVICE CARD

FOR IBM PERSONAL COMPUTER USERS

TECH JOURNAL

Volume 3, Number 1
January 1985

46



88

142

ARTICLES

DEPARTMENTS

TECH NOTEBOOK

PRODUCTS

Scroll & Recall™

Screen and Keyboard Enhancement
for the IBM - PC, XT and Compatibles

Allows you to conveniently scroll back through data that has gone off the top of your display screen.

Allows you to easily recall and edit your previously entered DOS commands and data lines.

Very easy to use, fully documented. Compatible with all versions of DOS, monochrome & graphic displays.

***$69** - Visa, M/C, Check, COD, POs*
Phone orders accepted

Make Your Work Easier!

To Order or to Receive Additional Information, Write or Call:
Opt-Tech Data Processing
P.O. Box 2167 • Humble, Texas 77347
(713) 454-7428
Dealer Inquiries Welcome

CIRCLE NO. 196 ON READER SERVICE CARD

OPT-TECH SORT™

SORT/MERGE program for IBM-PC & XT

Now also sorts dBASE II files!

- Written in assembly language for **high performance** Example: 4,000 records of 128 bytes sorted to give key & pointer file in 30 seconds. **COMPARE!**
- Sort ascending or descending on up to nine fields
- Ten input files may be sorted or merged at one time
- Handles variable and fixed length records
- Supports all common data types
- Filesize limited only by your disk space
- Dynamically allocates memory and work files
- Output file can be full records, keys or pointers
- Can be run from keyboard or as a batch command
- Can be called as a subroutine to many languages
- Easy to use, includes on-line help feature
- Full documentation — sized like your PC manuals
- **$99** —VISA, M/C, Check, Money Order, COD, or PO

Quantity discounts and OEM licensing available

To order or to receive additional information write or call:

OPT-TECH DATA PROCESSING
P.O. Box 2167 Humble, Texas 77347
(713) 454-7428
Requires DOS, 64K and One Disk Drive

CIRCLE NO. 179 ON READER SERVICE CARD

PC TECH JOURNAL

VOL. 3, NO. 1

PUBLISHER: *Newton Barrett*
EDITOR: *Will Fastie*

EDITORIAL
MANAGING EDITOR: *Marjory Spraycar*
TECHNICAL EDITORS: *Julie Anderson, Susan Glinert-Cole*
SENIOR COPY EDITOR: *Susan Holly*
COPY EDITOR: *Gail Shaffer*
CONSULTING EDITOR: *Thomas V. Hoffmann*
CONTRIBUTING EDITORS: *Ray Duncan, Richard Foard, Arthur A. Gleckler, Augie Hansen, William H. Murray, Max Stul Oppenheimer*
EDITORIAL SECRETARY: *Diana L. Carey*
EDITORIAL ASSISTANT: *Carole Autenzio*

ART & PRODUCTION
ART DIRECTOR: *Nancy Lepow*
ASSISTANT ART DIRECTOR: *Jane Frey*
ART ASSISTANT: *Sandra Ray*

ADVERTISING SALES
ASSISTANT TO PUBLISHER: *Julie Henderson*
ADVERTISING COORDINATOR: *Michele Fischetti*
DISTRICT MANAGERS:
Rita Burke, Ian Smith—East Coast
Lisa Kampfmann—Midwest
Ted Bahr, Bill Bush, Harriet Rogers—West Coast
ACCOUNT REPRESENTATIVES:
Jan Schultz—East Coast
Rosemarie Caruso—Midwest
Arlene Steadman—West Coast

CIRCULATION
SUBSCRIPTION DIRECTOR: *Chet Klimuszko*
DIRECT MAIL MANAGER: *Eric A. Bernhard*
RENEWAL AND BILLING MANAGER: *Shane Boel*
MEDIA MANAGER: *Ann Pichette*
SPECIAL SUBSCRIPTION SALES: *Daniel Rosensweig*

COMPUTER PUBLICATIONS DIVISION
GENERAL MANAGER: *Kenneth H. Koppel*
VICE PRESIDENT: *Eileen G. Markowitz*
VICE PRESIDENT, Editorial: *Jonathan D. Lazarus*
VICE PRESIDENT, Licensing & Special Projects: *Jerry Schneider*
VICE PRESIDENT, Creative Services: *Herbert Stern*
CIRCULATION DIRECTOR: *Alicia Marie Ivans*
CREATIVE DIRECTOR: *Peter J. Blank*
MARKETING MANAGER: *Ronnie Sonnenberg*
BUSINESS MANAGER: *Gary A. Gustafson*
EDITORIAL DIRECTOR: *Ernest F. Baxter*

ZIFF-DAVIS PUBLISHING
PRESIDENT, *Richard P. Friese;* PRESIDENT, CONSUMER MAGAZINE DIVISION, *Albert S. Traina;* EXECUTIVE VICE PRESIDENT, MARKETING AND CIRCULATION, *Paul H. Chook;* SENIOR VICE PRESIDENT, *Phillip T. Heffernan;* SENIOR VICE PRESIDENT, *Sidney Holtz;* SENIOR VICE PRESIDENT, *Edward D. Muhlfeld;* SENIOR VICE PRESIDENT, *Philip Sine;* VICE PRESIDENT, *Baird Davis;* VICE PRESIDENT, *George Morrissey;* VICE PRESIDENT, *Rory Parisi;* VICE PRESIDENT, *William L. Phillips;* TREASURER, *Selwyn Taubman;* SECRETARY, *Bertram A. Abrams*

EDITORIAL OFFICE
PC TECH JOURNAL, The World Trade Center, Suite 211, Baltimore, MD 21202. 301/576-0770. The Source ID STY682.

ADVERTISING OFFICES
(East Coast) One Park Avenue, New York, NY 10016. 212/503-5100.
(Midwest) 180 N. Michigan Avenue, Chicago, IL 60601. 312/346-2600.
(West Coast) 11 Davis Drive, Belmont, CA 94002. 415/594-2290.

SUBSCRIPTION INQUIRIES
PC TECH JOURNAL, P.O. Box 2968, Boulder, CO 80321. Subscription service: 800/631-8112. Back issues: send $7.00/copy to *PC TECH JOURNAL*, Box CN, 1914, Morristown, NJ 07960.

PC TECH JOURNAL (ISSN 0738-0194) is published 12 times a year, $29.97 for one year, $52.97 for two years, $69.97 for three years. Additional postage $12 for Canada & Foreign by Ziff-Davis Publishing Company, One Park Avenue, New York, NY 10016. Application for Second-Class Postage Rates pending at New York, NY 10001. POSTMASTER: Send address changes or subscription inquiries to P.O. Box 2968, Boulder, CO 80321.

PC TECH JOURNAL is an independent journal, not affiliated in any way with International Business Machines Corporation. IBM is a registered trademark of International Business Machines Corp. Entire contents Copyright © 1985 Ziff-Davis Publishing Company. All rights reserved; reproduction in whole or in part without permission is prohibited. Contact Jean Lamensdorf, Manager, Reprints/Rights & Permissions. 212/503-5448. BPA membership (Selected Market Audit Division) applied for October 1983.

BPA SELECTED MARKET AUDIT DIVISION

Adventures in COMDEXland

"Did you see anything new and exciting?"

It doesn't matter who I run into at a trade show like COMDEX. It could be a friend. A vendor. A fellow member of the press. One of my associates. My boss. Anybody. Every one of them shares a common characteristic: they all ask me the same question.

"Hey, Will! What have you seen that's new and great?" Or this variant: "Will! What's hot this year?"

It's an occupational hazard, I guess, just like all the people who find me just before Thanksgiving to ask me about the state of the Christmas computer industry. For the last few trade shows, however, the answer has been hard to find. I just haven't come away saying "WOW!"

Don't misunderstand: there certainly have been things at these shows that have taken my breath away. But what I go looking for are clues that will help me understand what is going to happen over the long haul, not just the pretty sights along the way. Insights gained from observing the industry in this way are far more valuable and lasting than excitement over someone's new spreadsheet package.

I came away from COMDEX '84 pretty confused.

DATA MANAGEMENT SYSTEMS

Silly me. I thought we were coming to a point in time at which vendors and products would begin to shake out and we would see the effect of the market at last. Instead, COMDEX witnessed a number of new information management products, some obviously well-financed. There were almost no casualties.

It seems clear to me that the industry is still in a high state of confusion over data management software. I see a lot of competent products out there and an equal number of technological and marketing strategies for them. I also see an important failure: no strong metaphor has emerged that provides the vital connection between the realities of human perception of information and the realities of storage and retrieval on computers. Some of the products on the market have superb human interfaces. Some of the products on the market have superb data management capabilities. None seems to have both.

Spreadsheet programs provided an immediate, visible metaphor. Every accountant and clerk saw an electronic ledger in front of their eyes, and they were off and running. The problem with information that is more general than numbers in a matrix is that each one of us thinks about it differently. As with word processors, we tend to choose information management software that suits our *tastes* more than our *needs*. And that kind of selection criteria tends to let the market run wild, producing more programs than we are possibly able to evaluate and then relying on us to choose subjectively among them.

Worse, when we all use different managers we create a data interchange problem of vast proportions. Almost every package worth its salt includes extensive import/export capability, but that is hard for the vendors to sustain and hard for us to assimilate.

Individual vendors will claim that their packages address these issues. I have yet to see it, and it is a continuing disappointment.

LOCAL AREA NETWORKS

I attended an interesting press conference hosted by Software Connections at which "The Year of the LAN" was announced. Oh, by the way, 1985 is the year of the LAN.

Well, okay, maybe. What was interesting about this particular conference was the panel. I have never seen that many LAN biggies in one place at the same time! I didn't even know they talked to one another. The panel included Bill Krause (3COM), Ray Noorda (Novell), Ken Biba (Sytek), Charlie Bass (Ungerman-Bass), Joe Hughes (Corvus), Dr. Charles Geisler (3M), Harry Saal (Nestar), and Bruce Bastl (Software Connections).

The superficial purpose of the meeting was to announce that LANs have arrived and to demonstrate unity among the vendors to that effect. However, the real purpose of the meeting, I think, was to demonstrate that the companies represented were still in business in the wake of IBM's announcements about local area networks. Sytek is obviously still in business.

There were only two really good points made. Charlie Bass, in an hysterically funny five minutes, pointed out that every year since 1979 has been referred to as *the* year and that he was having a generic "Year Of The LAN: 198_" slide made that would hold him for at least five more years. Harry Saal of Nestar, though, made the key point: at the moment, no software system or application exists that will drive PC owners to LAN, as VisiCalc drove us to PCs in the first place.

I agree with Harry and Charlie. LAN software is not standard (although Novell is doing a good job with NetWare) and is complicated. Applications are not yet ready to run on networks. In short, we cannot just pull software out of the box and run it, necessarily. I think the situation is far worse at the moment because of this complexity. Only two developments make me think that there may be light at the end of the tunnel: IBM's network (no matter what it is, it is IBM) and Novell's NetWare (the *only* thing two different networks are likely to be able to have in common).

A final note on LANs. Five of the eight panelists had, shall we say, uncomplimentary remarks about IBM, noting IBM's five LAN announcements in the last year and pointing to the confusion of it all. Those not mentioning IBM? Software Connections and Novell (because they are *software* companies and could care less about the underlying hardware) and Sytek (because it is in the driver's seat).

MODEMS

2400 baud is here.

We suspected its imminent arrival before COMDEX, but all the modem companies were showing off the new boxes. I stood back from one of the booths for a while and listened to what visitors had to say to the vendor. Big question: "Who can I talk to at 2400 baud?" Slickest answer: "Most of the interest in our new product comes from companies wanting to do file transfer faster than 1200 baud allows."

I think we can look for more and more of the public services to offer 2400 baud service, possibly at a premium, because the cost of the new modems is good. That is, the cost is much less than twice the cost of the 1200s. We are going to see a lot of action here.

By the way, kudos should go to U.S. Robotics for printing the reference card on the botton of their unit and providing easy, open access to the configuration switches.

GRAPHICS

Zip.

I expected to see a flurry of activity in the wake of the new IBM graphics subsystem announcements. I guess I figured that software vendors would be pitching their software in a new hardware context, while hardware vendors would be extolling the virtues of their hardware over IBM's. Neither seemed to be happening.

The point here is that IBM's new offerings allow powerful graphics workstations to be built out of XTs and ATs. For software companies in the graphics industry, this should be terrific news because a complete IBM hardware solution is attractive to the customer base. I am positive we will see this: I am just surprised that it was not visible at COMDEX '84.

COMDEX

Computer trade shows, except a few very strong, very narrow shows like SIGGraph, are in the doldrums.

A lot of journalists have already remarked on this fact, offering their own reasons for the malaise. Many of their theories center on the absence of any new, big announcement that will dazzle everyone. I have a slightly different theory.

Computer trade shows, especially the big ones, are still driven by technology. A lot of computer types visit; sometimes it seems the more technical, the better (even the techies wear coats and ties now, so they are sometimes harder to spot). And in the booths, the representatives are either technical themselves or know whom to collar to get a question answered. Other kinds of large trade shows (such as an automotive show, for example) are *marketing* driven. The most-often-asked question at such shows is not "What's neat?", but rather "What's sellable?" This is a very important, although subtle, distinction.

Las Vegas and Sheldon Adelson, the president of The Interface Group, are a little angry at each other. Mr. Adelson was fighting for us by trying to get more hotel rooms blocked out. Las Vegas refused, because computer conference delegates don't gamble as much as average folks and COMDEX rolled over into lucrative weekend time. Las Vegas and Mr. Adelson will kiss and make up, however, because over the next few years COMDEX, and the other big computer shows, will become ever more driven by market considerations. And it is those sales and marketing types, and those entrepreneurial dealers, who are always willing to roll the dice.

Don't worry, Las Vegas. We'll be back, more fun than ever.

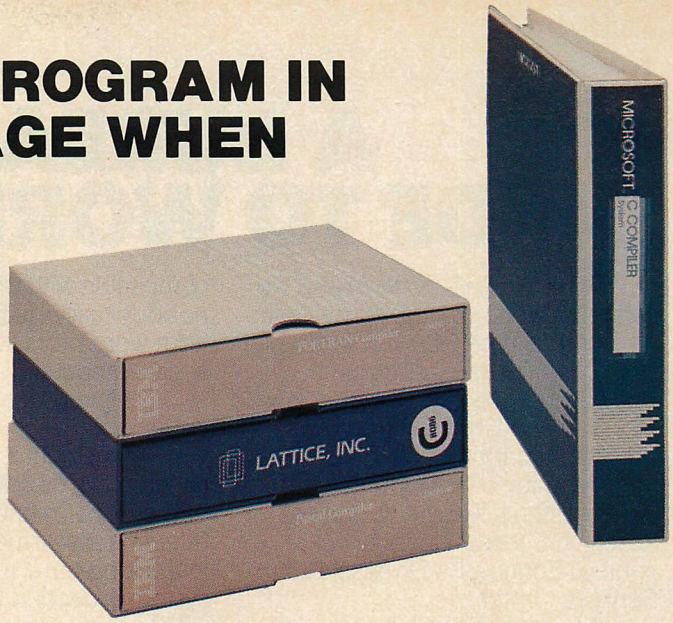
PRODUCT OF THE MONTH

This first issue in 1985 marks the debut of a new monthly department for *PC Tech Journal.* It is called Product of the Month.

Each month our technical editors and I will choose a product to feature based on programming detail, excellence in human factors and design, and applicability to the needs of our readers, advanced users of the IBM PC family.

A complete technical review of the product will appear in a subsequent issue of *PC Tech Journal.* See page 187 for our first Product of the Month, Turbo Pascal.

WHY DEBUG YOUR PROGRAM IN ASSEMBLY LANGUAGE WHEN YOU WROTE IT IN ONE OF THESE...



ATRON Announces Source Level Software Debugging

Without source level debugging, the programmer must spend time mentally making translations between assembly language and the C, PASCAL, or FORTRAN source code in which the program was written. These tedious translations burn up valuable time which should be spent making critical product schedules. The low level hex and symbolic debuggers available today are superceded by ATRON'S solution — Source Probe.

HOW TO SINGLE STEP YOUR SOURCE CODE AND KEEP CRITICAL DATA IN VIEW

With Source Probe, you can step your program by source code statements. While stepping, a window which you define can display critical high level data structures in your program. The next several source code statements are also displayed to give you a preview of what the program will do

HOW TO DISPLAY DATA IN MEANINGFUL FORMATS

Why look at program data in hex when you defined it to be another data type in your program. Source Probe provides a formated print statement to make the display of your variables look like something you would recognize. You can specify data symbolically too.

FIND A BUG — FIX IT RIGHT NOW

Source Probe provides an on-line text editor to allow you to log program corrections as you find them while debugging. With on-line display and editing of source files, the time lost printing and looking through program listings can be eliminated.

A SNAP SHOT OF REAL TIME PROGRAM EXECUTION — BY SOURCE CODE !

When Source Probe is running on ATRON'S PC PROBE hardware, the real time execution of the program is saved. You can then view your source code as it executed in real time — including all the changes the program made to your data variables.

HOW TO FIND A BUG WHICH OVERWRITES MEMORY

When running on PC PROBE, the Source Probe can trap a bug which overwrites a memory location. Because complex pointers are normally used in high level language programming, this bug occurs frequently and is very difficult to find.

A BULLET PROOF DEBUGGER

What good is a debugger that can be wiped out by an undebugged program? With Source Probe running on PC PROBE, the software is write protected and cannot be changed.

ATRON PROVIDES THE DEBUGGING TOOLS WHICH FIT YOUR PROBLEM

PC PROBE — A hardware aid to symbolic software debugging

SOFTWARE PROBE — A symbolic debugger, runs without PC PROBE

SOURCE PROBE — A source level debugger, versions run with or without PC PROBE

PERFORMANCE AND TIMING ANALYZER — For finding where your program spends its time

WE HAVE HUNDREDS OF HAPPY CUSTOMERS

ATRON produced the first symbolic debugger for the PC and the first hardware aided debugging tool — PC PROBE. We have hundreds of happy customers who have made their schedules because of ATRON debugging tools. Why waste more time — call us today!

atron
a debugging company

20665 FOURTH STREET • SARATOGA, CA 95070 • (408) 741-5900

CIRCLE NO. 107 ON READER SERVICE CARD

A BUREAUCRAT'S GUIDE TO WORD PROCESSING

Now, if it were you or I and we wanted a word processing program for our IBM-type PC, we'd probably stop off at our local computer store and simply diddle with a few.

You and I, however, are not the U.S. Department of Agriculture.

(Nor any of its permutations of subsystems like the Economic Research Service, National Resources Economics Division, Data Services Center, etc., etc.)

So when the USDA told ERS to tell NRED and DSC to look into a truckload of w.p. programs for all their PCs, the last thing they wanted was simple diddling. Their dedicated Wangs and Lexitrons were far too few to handle their needs, their IBM® PCs weren't compatible with them anyway, and nobody really, quantifiably, knew from word processing with a personal computer.

Definitely not a diddling-mode condition.

As they put it in The Exchange, an internally distributed publication of the Department of Agriculture: "A needs assessment showed that, in the long-term, a word processing system is needed that can increase word processing capability and also be compatible with ERS' Long Range Information Management goals."

Well, "Needs assessment" led swiftly to "procurement action," which galloped into an "objective review" of the eight top-rated PC programs on the market (as compiled by The Ratings Book published by Software Digest), along with WordStar® and Display Write 2, because they had some around.

Thus armed with the names, the final evaluators (a team of secretaries from NRED who would be the primary users of the PC software) became armed with each of the programs, along with checklists to record such things as ease of use, advanced features, and similarity to their existing dedicated equipment.

Since NRED has some hard disk base systems, any packages that were copy-protected could not be transferred to the hard disks, and were eliminated on that basis alone. OfficeWriter™ and SAMNA WORD™ II were the first to go.

Next, IBM's *Diplay Write 2*: because it's "not compatible with other software used in ERS (like Lotus™ 1-2-3,™ dBase II,® etc.)," and it's "full of confusing menu options and cryptic error messages." Au revoir IBM.

Then, three more, for a variety of reasons. Which left:

Volkswriter® Deluxe™
MultiMate™
Leading Edge™

Volkswriter® Deluxe? "Too complicated and confusing." Not "easy to learn or use."

MultiMate? Not bad. It actually tied the winner in a few categories.

The winner being the one that won 82% of the votes in the Ease of Use/Ease of Learning categories. The one about which they said, "The ability to store deleted text and automatic document backup features were both highly desirable." The one they thought they'd quickly "be able to use . . . for their day-to-day word processing tasks."

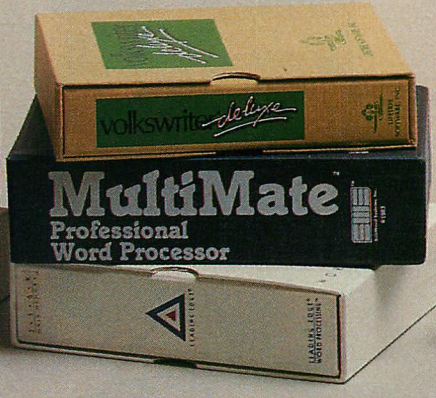
The whole process took some three months of work by people in DSC to support the NRED in its work with the ERS and DSC to make the world a better place for the USDA.

But the results were well worth the wait. Because at last they've solved their word-processing problems . . .

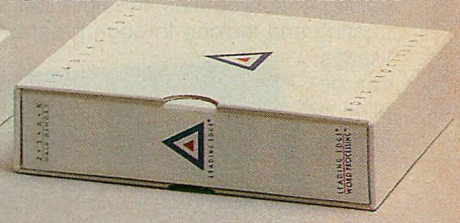
"With Leading Edge!"

THESE ARE THE PACKAGES THE COMMITTEE EVALUATED:

THESE WERE THE FINALISTS:



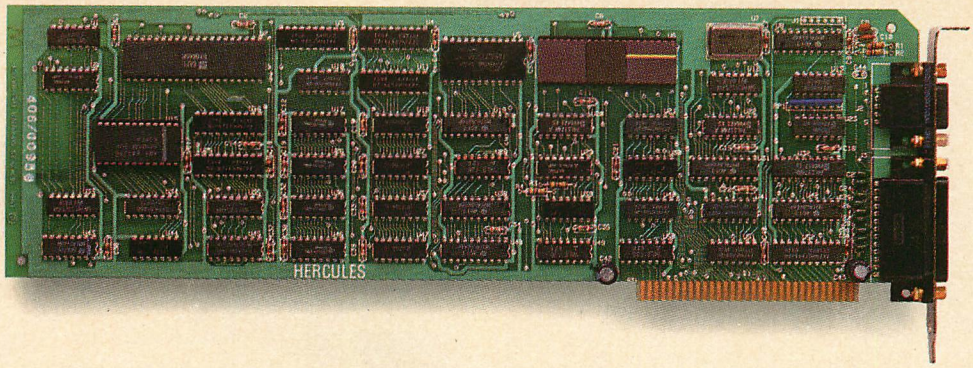
THIS WAS THE WINNER:
LEADING EDGE™
LEADING EDGE WORD PROCESSING



LEADING EDGE PRODUCTS, INC.
LEADING EDGE SOFTWARE DIVISION, 21 HIGHLAND CIRCLE, NEEDHAM, MA 02194-0009 TEL. 800-343-3436, (617) 449-4655
HELP HOTLINE 800-523-HELP

IBM is a registered trademark of International Business Machines. WordStar is a registered trademark of MicroPro International Corporation. OfficeWriter is a trademark of Office Solutions Inc. SAMNA WORD II is a trademark of SAMNA Corporation. Lotus and 1-2-3 are trademarks of Lotus Development Corporation. dBase II is a registered trademark of Ashton-Tate. Volkswriter is a registered trademark and Deluxe is a trademark of Lifetree Software Inc. MultiMate is a trademark of MultiMate International Corporation. Leading Edge is a trademark of Leading Edge Products, Inc.

CIRCLE NO. 163 ON READER SERVICE CARD



Introducing the Hercules™ Graphics Card for the technical user.

OK. We confess. The Hercules Graphics Card in the picture above isn't a special version for the technical user.

In fact, it's exactly the same as the standard Hercules Graphics Card running programs like 1-2-3™ and Symphony™ in more than 100,000 IBM® PCs.

We just wanted to make the point that the Hercules Graphics Card is not only big with business users—it's also the most popular high resolution graphics card for the technical user.

Why? We run more software than anyone else.

The Hercules Graphics Card is supported by more technical software than any other hi-res graphics card.

There are word processors that can produce publication quality documents with mathematical formulas.

There are programs that enable your PC to emulate a graphics terminal and run mainframe graphics software.

There are toolkits of graphics utilities that can be linked to popular programming languages.

There are CAD programs that can provide features normally associated with $50,000 systems.

And we supply free software with each card to do hi-res graphics with the PC's BASIC. No one else does.

Hardware that set the high performance standard.

When we introduced the Hercules Graphics Card in August, 1982, it set the standard for high resolution graphics on the PC.

But we didn't stop there. In the past two years, we've continually refined the original design.

Today's Graphics Card gives you two graphics pages, each with a resolution of 720h x 348v, and a parallel printer port—standard.

A 2K static RAM buffer elegantly eliminates scrolling flicker. And our exclusive safety switch helps prevent damage to your monitor.

Convinced? Good. Now, how about a little color?

Should you want IBM compatible color graphics for your system, then the new Hercules Color Card is the smart way to go.

It gives you a parallel printer port and a size small enough to fit in one of the XT's or *Portable's* short slots.

And both Hercules cards are compatible with the new AT™ and backed by our two year warranty.

Call 800 255-5550 Ext. 403 for the name of the Hercules dealer nearest you and we'll rush you a free info kit. See why the company that made the first graphics card for the IBM PC still makes the best.

Hercules.
We're strong on graphics.

Address: Hercules, 2550 Ninth St., Berkeley, CA 94710 Ph: 415 540-6000 Telex: 754063 **Trademarks/Owners:** Hercules/Hercules Computer Technology, 1-2-3, Symphony/Lotus Development; IBM, AT/International Business Machines

CIRCLE NO. 133 ON READER SERVICE CARD

Introducing the most powerful

The new IBM Personal Computer AT.

Hold on to your hat.

The new IBM Personal Computer AT (for Advanced Technology) is based on the advanced 80286 16-bit microprocessor. This remarkable computer will run many of the programs written for the IBM PC, up to three times faster. You'll be able to recalculate large spreadsheets in seconds and retrieve files in a flash.

It's got the power (and price) to surprise you. In many ways.

Compatibility, expandability, networking too.

With the IBM Disk Operating System, the IBM Personal Computer AT can use many programs from the fastest-growing library in the personal computer software industry.

The IBM Personal Computer AT is also available with up to 3 million bytes of user memory to run multiuser, multitasking operating systems such as XENIX™. Volume upon volume of information is available at your fingertips. You can customize your system to store up to 20,000 pages of information at one time. And its keyboard helps you use all of this computing power more easily.

This new member of the IBM PC Family is a powerful stand-alone computer that can also be both the primary file server and a station on your network. With the new IBM PC Network (which is so easy to connect you can do it yourself), the IBM Personal Computer AT can share information with IBM PCs, PC/XTs and IBM *Portable* PCs.

IBM Personal Computer AT Specifications

User Memory
256KB-3MB*
Microprocessor
16/24-bit 80286*
Real and protected modes*
Auxiliary Memory
1.2MB and 360KB diskette drives*
20MB fixed disk drive*
41.2MB maximum auxiliary memory*
Keyboard
Enlarged enter and shift keys
84 keys
10-foot cord*
Caps lock, num lock and scroll lock indicators
Display Screen
IBM Monochrome and Color Displays
Operating Systems
DOS 3.0, XENIX*
Diagnostics
Power-on self-testing*
Parity checking*
CMOS configuration table with battery backup*
Languages
BASIC, Pascal, FORTRAN, Macro Assembler, COBOL, APL
Printers
Supports attachment of serial and parallel devices
Permanent Memory
(ROM) 64KB
Clock/calendar with battery*
Color/Graphics
Text mode
Graphics mode
Communications
RS-232-C interface
Networking
High-performance, high-capacity station on the IBM PC Network*

*Advanced Features for Personal Computers

Get a hands-on, hats-off demonstration.

The new IBM Personal Computer AT has the power, compatibility and expandability many PC users need, at a very appealing price.

For more information contact your authorized IBM PC dealer, IBM Product Center or IBM marketing representative. For a store near you call 1-800-447-4700. In Alaska or Hawaii call 1-800-447-0890. IBM®

CIRCLE NO. 152 ON READER SERVICE CARD

personal computer IBM has ever made.

Little Tramp character licensed by Bubbles Inc.. s.a.
XENIX™ is a registered trademark of Microsoft Corporation.

Not long ago, *PC* Magazine called MDBS III "The most complete and flexible data base management system available for microcomputers." That's a powerful statement. But then, MDBS III is an amazingly powerful software package. So powerful, in fact, that it lets you build mainframe-quality application systems on your micro or mini. MDBS III is not for beginners. It's for application developers with large data bases or complex data interrelationships who want to define data base structures in the most natural way—without resorting to redundancy or artificial constructs. It's for professionals who can appreciate its extensive data security and integrity features, transaction logging, ad hoc query and report writing capability and its ability to serve multiple simultaneous users. And if you want the power and the glory that only the world's most advanced data management system can provide, MDBS III is for you. For information on MDBS III and our professional consulting services, write or call Micro Data Base Systems, Inc., MDBS/Application Development Products, 85 West Algonquin Road, Suite 400, Arlington Heights, IL 60005. (800) 323-3629, or (312) 981-9200. **MDBS III. ABSOLUTE POWER.**

WE'LL GIVE YOU THE POWER.

YOU TAKE THE GLORY.

MDBS III is a trademark of Micro Data Base Systems, Inc.

CIRCLE NO. 219 ON READER SERVICE CARD

FURTHER EMULATION

The article "High-Tech Mimicry" (Augie Hansen, September 1984, p. 46) left out PC-VT. PC-VT is program for the IBM PC that emulates Digital Equipment Corp.'s VT100 and VT102 video terminals.

Among the capabilities of PC-VT are: terminal set-up screen forms identical to SETUP A and SETUP B of the VTs; a cursor-type UL/block select from SETUP B; simulation of PF1-PF4 keys; VT52 emulation; ANSI/VT52 selection; scrolling region; cursor keys on the numeric keypad and the function keys, plus special keys set up for the EDT editor; reverse-screen mode; wraparound ON/OFF; settable tabs; full VT102 emulation; select graphic rendition; LED display, with line 25 used as a status line to display program and comm line status; and BREAK signal key.

PC-VT also provides a Hayes-compatible dialing directory, ASCII and XMODEM file transfer protocols, support of DOS 2.x path names for file transfers, LPT1 as a local printer, COM1 or COM2 serial port, and the NO SCROLL key.

I distribute the program as user-supported software. I will send a copy of PC-VT plus documentation to anyone who sends me an IBM-formatted DSDD diskette, a mailer, and return postage. Send your request to 9067 Hillery Drive, San Diego, CA 92126.

Mark C. DiVecchio
San Diego, CA

BUT WHAT ABOUT COMPATIBILITY?

You more than atoned for a poor June issue (devoted entirely to dBASE) with the November issue—a nice mix of product reviews and programming subjects. Thomas Hoffmann's hard-disk review ("Ten by Ten," p. 52) was especially timely and well-done. There simply is no source of good, unbiased information about such products other than thorough head-to-head comparisons, as Hoffmann did.

One item that I wish he (and other reviewers) would address is the hardware and software compatibility of the product they are reviewing with very popular expansion products. This is especially true for AST and Quadram hardware and software because they are so widely used and now sold at IBM Product Centers (AST boards). Since Hoffmann did not report any conflicts, may we assume that his Persyst hardware, RAM drive, and spooler ran perfectly with all the hard disks tested?

Again, my compliments on a well-done issue and hard-disk review.

J.T. Keuler
Seattle, WA

The hardware ran fine with all of the fixed-disk units tested, but I did not test any RAM drive or spooler software with them. I can't think of any reason why they would not be compatible.

—Thomas Hoffmann

THE LANGUAGE OF THE SIXTIES

Gregg Pettit claims, "Assembly language is a powerful and useful tool; it can make a computer do anything within that computer's capability" ("Best of Both Worlds," September 1984, p. 151). And after arguing that you have to be an "expert programmer" to do anything that could be considered useful in a higher-level language, Pettit claims that ". . . for developing utilities, general-purpose programs, interactive graphic games, etc., assembly language is probably still the best choice . . ."

Nor is there a shortage of assembly language elsewhere in the book. A second article extracts from Chris Morgan's *Bluebook of Assembly Language Routines* ("Strings," p. 111), and a third ("Assemblers without Ulcers," Eric S. Raymond, p. 173) claims that "Macros can enable you to turn your ASM-86 into something resembling a structured programming language." Raymond's views of assemblers is a little more to my liking: he calls them "notoriously tricky, unforgiving beasts that embody all the most frustrating characteristics of dealing with computers."

Please, folks, can we leave the 1960s and get on with computers. In 1965 when IBM announced the 360, everybody went rushing out to write huge, lumbering, unmaintainable programs in assembly language. People said, "We have to write in assembler because there's no alternative."

Two decades later I find that the voices have not changed, but the excuses have evaporated.

The time it takes to learn C or PL/1 well may be a small percentage higher than the time it takes to learn assembly language well, although I doubt it. The time it takes to write a program in C or PL/1 and get it right is certainly much less than the time to write the same program in assembly language—even with the many "structured programming" macro sets such as the one Pettit upholds or the one Raymond starts to write. Furthermore, a programmer's time has to be worth more than CPU time—although not all readers seem to realize how radical a change this represents from 1965.

A few lines of assembly language here and there may be excusable if you have a brain-truncated CPU that limits your memory space to some small multiple of 64KB, or that requires magic instruction to do I/O operations. That is no excuse for writing general utilities in assembly language—especially since there are decent compilers for C and other languages. Let's move programming into the 1970s, at least.

In fairness to Raymond, he does provide the programmer with an alternative: a way of using a few lines of as-

sembly language here and there when working in a high-level language.

Ian F. Darwin
Toronto, Canada

PROBLEMS WITH PROG

Ron Bauman's illustration of the use of the DOS 2.0 EXEC function ("BASIC Elegance," October 1984, page 181) would have been very useful to the reader if someone, somewhere along the line, had actually assembled, linked, and run the program. The program, as shown in the listing, will crash on execution because the IBM Macro Assembler appears to combine segments of the same name before they are organized according to class; unfortunately, it moves the small "dummy" PROG segment (defined right after the group definitions) back to the main PROG segment, which contains the actual code. This results in the linker seeing the "code" class *after* it has encountered the "data" class, so all of the program code follows the end of the stack. Since the overlays and the child programs are directed to load at the end of the stack, they overwrite the spawning program. Then when the child process is exited, control returns to the location of the overwritten code, and it's time to reach for the big red switch.

The problem is solved simply by renaming the dummy segment to something other than prog. Then the program performs as advertised. Admittedly, IBM's documentation for version 2.0 of the linker implies that Bauman's listing should function correctly, but the real world has shown otherwise, and as always, it has the last word.

Thanks for the opportunity to sound off. We enjoy your magazine.

Robert L. Wears, M.D., FACEP
Donald R. Kamens, M.D., FACEP
Wears & Kamens Computing
Jacksonville, FL

My thanks to Drs. Wears and Kamens for identifying a fix that is needed in order to build BASLDR correctly with the IBM Macro Assembler.

They have noted one of the many bugs inherent in the IBM Macro Assembler that caused me to abandon it last spring in favor of Microsoft's Macro Assembler, version 1.25. I apologize for not explicitly stating in the article that Microsoft's Assembler was used to assemble the source as printed.

Though the page headings on the listings indicate the sources were assembled using the Microsoft Assembler, no one thought to test the assemblies using the IBM assembler. The PROG segment declaration at the beginning of BASLDR is intended to force the linker to order the PROG code segment ahead of the data and stack segments. This is consistent with both the assemblers' and the linkers' documentation and is required as Drs. Wears and Kamens discovered.

I suggest that 8086/88 assembly language programmers consider upgrading to the Microsoft assembler for serious development work. The Microsoft Macro Assembler, a later and more credible version of the IBM Macro Assembler, has remained compatible, so changes to existing sources would not be necessary. The savings in time not spent in finding work-arounds easily outweighs the $85 or so spent on the Microsoft Assembler.

—Ron Bauman

A WINNING RELAY

I have been using the Relay software package for some time and was pleased to read the article, "Instant Relay," (Augie Hansen, October 1984, p. 94). Relay is an excellent package and deserved this informative review.

One point not discussed was that to achieve the voice/data switching alluded to in the beginning of the article a particular modem works far better than any other with the Relay software. Using a POPCOM modem from the Prentice Corporation in Sunnyvale, California, allows the user to switch between voice and data by picking up the phone. When the phone is returned to the cradle, file transfer automatically restarts. For peer-to-peer communication, this combination of Relay software and POPCOM modem is the best solution I have seen or heard of.

I have been reading *PC Tech Journal* for a few months and wish to commend you. A readable and technical journal is a rare combination.

Ken Krechmer
Palo Alto, CA

SIGNIFICANT COMMENTS

"Significant Figures, I" (Robert Gray, October 1984, p. 54) is an excellent description of how to do floating-point addition and subtraction using 8088/86 assembly language. There are, however, two errors in the FLOAT.ASM routine.

On the left side and near the top of page 62 are the following lines:

```
CMP     CL,24
JLE     A4
```

The second instruction should be replaced by

```
JBE     A4
```

With the original JLE instruction, a problem occurs when we add a very small number to a very large one. In that case, the CL register (which contains the difference between the two exponents) can be 128 or more. Because JLE assumes a signed comparison, 128 would be regarded as a negative number and we would jump to the wrong place. By using JBE instead we properly test the flags for an unsigned comparison. Actually, even with the bug, the code produces the correct result, but it takes a long time to do it because the loop at label A8 is unnecessarily executed up to 255 times.

The second bug causes occasional incorrect rounding when a subtraction is performed. This happens because the sticky bit is added to the result instead of being subtracted. I propose the following changes to correct this.

Delete the following three lines, which precede label A9 (left side of page 62 at the bottom):

```
        MOV     CL,3FH
        AND     CL,DH
        AND     DH,0C0H
```

Replace the following line

```
A9:     OR      DI,DI
```

with these four lines

```
A9:     OR      CH,CH
        JZ      A9B
        OR      DH20H
A9B:    OR      DI,DI
```

On the right side of page 62, delete the following lines:

```
R0:     OR      CH,CL
        JZ      R1
        OR      DH,01000000B
```

Finally, change the label on the following line:

```
R1:     R       DH,DH
```

to read

```
R0:     OR      DH,DH
```

"Significant Figures, II," (Robert Gray, November 1984, p. 173) demonstrates a far more efficient way of doing floating-point division in 8086/88 assembly language than the more familiar "subtract and shift" algorithm. There are, however, two minor bugs in the routine, called DIV_F.ASM, that is shown in listing 3 on p. 184.

If the dividend is zero and the divisor is less than 1, the code erroneously gives a nonzero quotient. This can be fixed by testing the dividend for zero and, if necessary, forcing a zero result. The following line near the beginning of the routine

The Ultimate Drive!

Peachtree Peripherals P-10 Series tackles these tough hard-disk questions.

I need a quality hard disk — What's so special about the P-10 ten-megabyte hard disk drive?

EVERYTHING. From design to performance, the P-10 series is unique. Nothing performs like it. Nothing lasts like it. Because the P-10 series features a special "sputter-applied" carbon coating on the disk surface — an advanced 3RD GENERATION TECHNOLOGY UNAVAILABLE UNTIL NOW. This makes the P-10 the "Hardest Drive" in the industry.

Why's that so important?

DURABILITY. The super-hard carbon coating gives the P-10 series unsurpassed durability and unmatched reliability. So your data stays intact even in the toughest of day to day business environments.

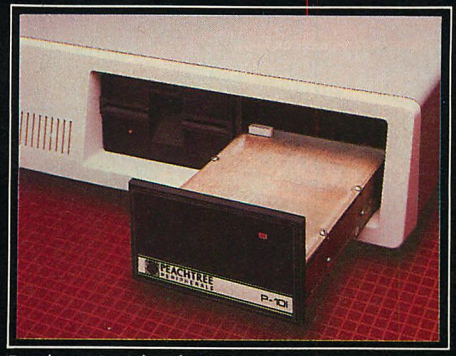
LOW POWER CONSUMPTION. The hard carbon coating on the disk platter surface virtually eliminates head to disk sticktion and drag. This is an enormous factor in reducing strain on your PC power supply during system start-up.

That's good — but what if I need more than 10 megabytes?

DON'T WORRY. The Peachtree Peripherals series offers true upgradability. **10 megabytes is just the start!** Add **20, 30, 40** megabytes (or more!) by adding Slave Units.

What if I already have a hard disk?

GREAT. The P-10e is the perfect back-up for your XT or your present hard-disk-upgraded PC. It also costs less than a 10 megabyte tape drive. Remember, the only true image of a winchester is another winchester. The P-10e Slave will work with the XT controller or other



Peachtree Peripherals P-10i

compatible hard disk controller cards. Plus, the P-10e is rugged and compact, so it makes an excellent worry-free portable drive. Put it in your briefcase and you're ready to go. And since the ENTIRE drive is portable, you'll never have disk interchange problems.

Am I buying my hard disk from a reliable company?

YOU ARE IF YOU LOOK TO PEACHTREE PERIPHERALS. We have a staff of experienced industry disk drive veterans. We will continue to offer our customers a complete line of quality peripheral products. Our P-10 series is tested and proven, with over a thousand units in the field. It also comes with a one-year parts & labor warranty. This is one drive you can buy with total confidence.

The P-10 series sounds superior — but I can't spend a fortune.

YOU DON'T HAVE TO. The P-10 series is competitively priced. Internal ten Megs for as low as **$795.00**. External slaves for only **$595.00**. For performance, durability, reliability, and cost, you can't make a better choice. Of course the P-10 comes with auto-boot feature, cables, mounting hardware, & instructions, allowing for plug & play convenience. The P-10 series from Peachtree Peripherals is the answer. To find out more about this remarkable line of hard disk drives, visit your local computer retailer or write

PEACHTREE
PERIPHERALS

3020 Business Park Dr., Suite A, Norcross, GA 30071, 404-662-5158

CIRCLE NO. 203 ON READER SERVICE CARD

NEW from BORLAND!

TURBO TOOLBOX & TURBO TUTOR

"TURBO is much better than the Pascal IBM sells."

Jerry Pournelle,
Byte, July 1984

"TURBO PASCAL appears to violate the laws of thermodynamics.

You won't find a comparable price/performance package anywhere. It is simply put, the best software deal to come along in a long time. If you have the slightest interest in Pascal . . . buy it."

Bruce Webster,
Softalk IBM: March 1984

BORLAND INTERNATIONAL GIFT PACK

ONLY **$99.95**

A SAVINGS OF $30!

What a gift for you and your friends! The extraordinary TURBO PASCAL compiler, together with the exciting new TURBO TOOLBOX and new TURBO TUTOR. All 3 manuals with disks for $99.95.

TURBO PASCAL Version 2.0 (reg. $49.95). The now classic program development environment still includes the FREE MICROCALC SPREAD SHEET. Commented source code on disk

- Optional 8087 support available for a small additional charge

NEW! TURBO TOOLBOX (reg. $49.95). A set of three fundamental utilities that work in conjunction with TURBO PASCAL. Includes:

- TURBO-ISAM FILES USING B+ TREES. Commented source code on disk
- QUIKSORT ON DISK. Commented source code on disk
- GINST (General Installation Program)

Provides those programs written in TURBO PASCAL with a terminal installation module just like TURBO'S!

- NOW INCLUDES FREE SAMPLE DATABASE . . . right on the disk! Just compile it, and it's ready to go to work for you. It's a great example of how to use TURBO TOOLBOX and, at the same time, it's a working piece of software you can use right away!

NEW! TURBO TUTOR (reg. $29.95). Teaches step by step how to use the TURBO PASCAL development environment—an ideal introduction for basic programmers. Commented source code for all program examples on disk.

30 DAY MONEY BACK GUARANTEE These offers good through Feb. 1, 1985

For VISA and MASTERCARD order call toll free: **1-(800)-255-8008 1-(800)-742-1133**
(Lines open 24 hrs., 7 days a week) Dealer and Distributor inquiries welcome (408) 438-8400

CHOOSE ONE (please add $5.00 for handling and shipping U.S. orders)

___ All Three-Gift Pack	$ 99.95 + 5.00 **SPECIAL!**	___ Turbo Toolbox	$49.95 + 5.00
___ All Three & 8087	139.95 + 5.00 **SPECIAL!**	___ Turbo Tutor	29.95 + 5.00
___ Turbo Pascal 2.0	49.95 + 5.00	___ Turbo 8087	89.95 + 5.00

Check_____ Money Order_____ VISA_____ MasterCard_____

Card #: _____ Exp. date: _____ Shipped UPS

My system is: 8 bit ___ 16 bit ___

Operating System: CP/M 80 ___ CP/M 86 ___ MS DOS ___ PC DOS ___

Computer: _____ Disk Format: _____

Please be sure model number & format are correct.

NAME: _____

ADDRESS: _____

CITY/STATE/ZIP: _____

TELEPHONE: _____

California residents add 6% sales tax. Outside U.S.A. add $15.00 (if outside of U.S.A. payment must be by bank draft payable in the U.S. and in U.S. dollars). Sorry, no C.O.D. or Purchase Orders.

6

BORLAND INTERNATIONAL

4113 Scotts Valley Drive
Scotts Valley, California 95066
TELEX: 172373

INTRODUCING
Interface Technologies' Modula-2 Software Development System

The computer press is hailing Modula-2 as "the next standard in programming languages." Modula-2 combines the strengths of Pascal with the features that made C so popular, like independent compilation and direct hardware control.

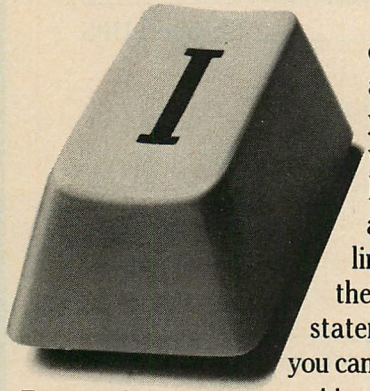
But until today, no company offered a Modula-2 system that made the development of software fast, easy and efficient. Now, though, there's a new tool at your disposal.

The fast, powerful tool for programmers

The breakthrough is here: Interface Technologies' new Modula-2 Software Development System for the IBM® PC, XT, AT and compatible computers to give programmers the same quantum leap in productivity spreadsheets and word processors gave to end-users. It can reduce monotonous wait time, will dramatically increase speed, help stop thoughtless mistakes, and free you to become more creative in virtually all of your programming efforts.

How to speed input and eliminate 30% of errors

Thirty percent of programming mistakes are syntax errors and simple typos in the program structure. Our "syntax-directed" Modula-2 editor does away with these time-consuming headaches once and for all.



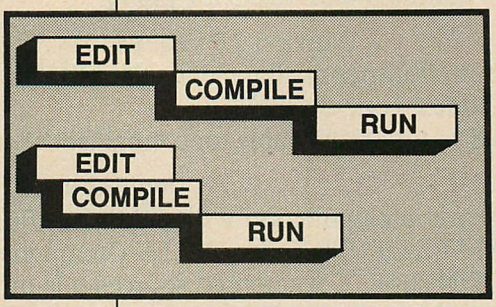
Enter complete statements with one keystroke.

It speeds input by cutting manual typing as much as 90%, letting you enter statements with a single keystroke. For example, if you type a capital "I" to begin a line, the editor completes the logical "IF THEN" statement automatically, so you can concentrate on what you want to program, rather than concentrate on what you're typing.

The editor locks out errors, finishing statements and procedures in perfect accord with the standardized rules of Modula-2. It also indents and formats your text automatically, making programs easy to read and maintain, an important feature on big projects.

And if you leave an undefined variable or data type, the editor detects the mistake and gives you the option of on-line "help" to correct it. No other programming text editor offers you so much innovation at any price.

How to turn "wait time" into "work time"



It not only has a faster compiler, it also saves time by compiling <u>while</u> you edit.

The vast majority of programming time is spent waiting, and the biggest slowdown is most often with compilers.

THE ANATOMY OF A

Our compiler turns wait time to work time with a new innovation that lets you compile in the "background."

With background compilation, your program is automatically compiled into object code line by line as you work, every minute you spend writing or editing a Modula-2 program!

When you're finished editing, all that's left for the compiler is a quick mopping up job that generates optimized native code in a single pass.

How quick is "quick"?

Thanks to background compilation and the fact that the compiler itself is so fast, Interface Technologies' compiler turns 100 lines of typical Modula-2 text into optimized machine code in *under five seconds.*

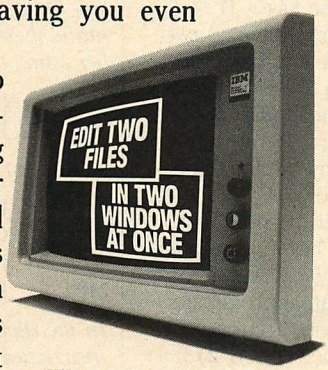
Plus the Interface compiler produces compact code with execution speed superior to that produced by any other Modula-2 compiler on the market.

How to do two things at once

Along with the background compiler and syntax-directed editor, which can save you hours every day and make you more productive, Interface Technologies' Software Development System gives your monitor

windows so you can refer to one file while you edit another simultaneously, saving you even more time.

Concurrent editing of two or more files is especially useful when doing programming work that's intended for separate compilation, and Interface Technologies has the only Modula-2 system on the market that provides you with this helpful benefit for developing software.

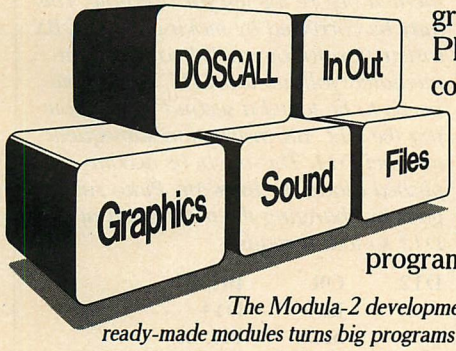


Work with multiple files faster, easier in windows.

How preprogrammed modules speed development

One of the advantages of Modula-2 is that it lets you build large, reliable programs quickly, by linking together many smaller "building-block" modules.

The development system's toolkit of precompiled program modules includes the standard Modula-2 library, and adds exclusive link-and-run modules for direct calls to the operating system, sound, and color graphics support. Plus you get low-cost updates from the Interface Technologies fast-growing library of new programming modules.



The Modula-2 development system's toolkit of ready-made modules turns big programs into smaller projects.

Increase productivity for $249

Interface Technologies' Software Development System is fast, powerful and unlimited. It works so well that it's the same tool Interface Technologies is using to write business and consumer applications in Modula-2.

For $249, you get the syntax-directed editor and compiler, linker, module library and tutorial that will have even modestly experienced programmers writing in Modula-2 in days. And you have full rights to your work; there's no license fee for programs you develop with the Interface Technologies system.

You can use it on any IBM® PC, XT, AT or compatible computer with two double-sided, double-density floppy drives and 320K RAM diskette.

You get a thoroughly indexed, comprehensive user's manual and free telephone support from Interface Technologies. But the most important thing you get is the future, and *the programming language of the future is Modula-2*, and now it's easier than ever.

For more information, or to order the Modula-2 Software Development System, call 1-800-922-9049 today. In Texas, call (713) 523-8422.

You can also order or request further information by mail. Just fill out the coupon below and send it in. Act today and receive your system soon.

Operates on the new IBM PC AT, as well as the PC, XT, and all other IBM-compatible computers.

BREAKTHROUGH

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE _____

PLEASE CHECK ONE:

☐ AMERICAN EXPRESS ☐ VISA ☐ MASTERCARD

☐ CHECK ENCLOSED

CHARGE ACCOUNT NUMBER

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

_____ _____

EXPIRATION DATE SIGNATURE

PLEASE SEND ME _____ COPIES @ $249 EACH.

INTERFACE TECHNOLOGIES CORPORATION

3336 RICHMOND, SUITE 200, HOUSTON, TX 77098

Texas residents, add 6.125% Sales Tax. **PC/2**

INTERFACE TECHNOLOGIES

MODULA-2 SOFTWARE DEVELOPMENT SYSTEM

IBM is a registered trademark of International Business Machines Corporation.

CIRCLE NO. 123 ON READER SERVICE CARD

```
D1:   MOV  AL,CL
```

should be replaced by

```
D1:   MOV  AX,[DI]     ;test if dividend
      OR   AX,[DI]+2   ;equals zero
      JNZ  D1B
      SUB  DX,DX       ;zero quotient
      MOV  AX,DX
      MOV  BX,DX       ;set status = OK
      JMP  EXIT
D1B:  MOV  AL,CL
```

The tests for overflow and underflow are incomplete. As a result, overflow is sometimes indicated when it in fact does not occur. Even worse, underflow is sometimes not flagged and an erroneous (very large) quotient is returned. The code only checks the difference between the exponents of the two operands against limits of 255 and 0. This is usually sufficient, but in marginal cases it is also necessary to see which of the two mantissas is larger.

One way to fix this bug is to defer the overflow/underflow test until the division has been done and then check the value of the quotient. This allows us to use a very simple test in which overflow is flagged if the biased exponent is greater than 255 and underflow if the exponent is negative.

In line with this, I suggest that the following lines (right side of page 184 at the bottom) be deleted;

```
      CMP   BX,255
      JLE   D3
      JMP   D13
;
D3:   CMP   BX,0
      JGE   D5
      JMP   D14
```

Then replace the line (right side of page 186)

```
D12:  MOV   BH,BL
```

with

```
D12:  OR    BH,BH
      JS    D14
      JNZ   D13
      MOV   BH,BL
```

There is a special case of underflow that will not be detected by the above code. This occurs when the true result of a division is 2^−129. In this case, the exponent will be 0 and the mantissa (after the sign bit is reset) will also be 0. This is indistinguishable from the bit configuration (all 0s) that Mr. Gray uses to represent the value 0 and should thus be flagged as underflow. I regard this as an insignificant problem.

I also have some suggestions that would make floating-point division even faster. In computing the factor B = (M2LO/M2HI)/2^16, Mr. Gray uses two DIV instructions to get a 32-bit value (see code at label D7). I, however, assert that executing instead just one DIV instruction and getting a 16-bit value for B would not in any way diminish the accuracy of the routine.

To explain, first let me note that the second word of B has a value on the order of 2^−32 or less. As Mr. Gray states, B itself is only an approximate correction factor. A more accurate correction factor would be (B − B^2). Since B can be as large as 2^−15 (if M2LO=0FFH and M2HI-8000H), B^2 could approach 2^−30. Thus, the inherent error in B could be at least four times as great as the error that arises from ignoring the second word of B. This means that nothing is gained by computing the latter.

After computing B, Mr. Gray subtracts B from 1 to get (1−B). He then calculates A = (M1/M2HI) and then finally computes the mantissa of the quotient as M = A * (1−B). This is a full 32-bit multiply and requires the execution of four MUL instructions.

A better idea would be to compute A * B first and then to calculate M = A − (A * B). Doing the computation this way requires only a single MUL instruction because A * B is on the order of 2^−16, and, therefore, only the high word of this product is necessary. Any additional words would be smaller than the built-in error of this technique.

Robert Pirko
New York, NY

Let me begin by thanking Mr. Pirko and Mr. Paterson (whose letter follows below), both of whom have evidently spent quite a bit of time in preparing their comments. If these two are typical, I can say only that the readers of PC Tech Journal *are very astute.*

Each of Mr. Pirko's comments appear to be correct. The rounding error that he reports is minor—it will occur only after some (but not all) subtractions. Unfortunately, it is due to a major oversight. The sticky bit is not, as he suggests, added to the result; rather, it is simply not subtracted. His fix not only corrects the problem, but actually improves the code. The reader will note that, strictly speaking, my addition routine does not keep a sticky bit—shifted bits are stored in registers DH and CX. Mr. Pirko condenses these into a true sticky bit in DH. His change, however, requires changes in the rounding routine that begins at label R0. Since the multiplication routine jumps to this label, the following change should be made there: on page 184 of the November issue, the instructions

```
      JMP   R0
MF2:  JMP   FINISH
```

should be changed to

```
      JCXZ  R0
      OR    DH,20H
      JMP   R0
MF2:  JMP   FINISH
```

In the division routine on page 186, the instructions

```
      SUB   CX,CX
      POP   DI
      JMP   R0
D13:  POP   DI
```

may be changed to

```
      POP   DI
      JMP   R1
D13:  POP   DI
```

How I omitted to test for a 0 operand or (worse) to catch the omission during testing is, I suppose, one of those mysteries given to programmers to ponder as intimations of their own infirmity. Mr. Pirko has spotted the omission, however, and has given a workable fix.

Mr. Pirko's comments on overflow and underflow may not be clear as they stand. However, as the division routine now works, the exponent is incremented (after label D1) to compensate for a later right shift in the mantissas. The problem is that it is incremented before the test for overflow. This may be corrected by moving the INC BX instruction following D1 so that it immediately follows label D5. Underflow needs to be tested a second time following the DEC BX instruction subsequent to label D11. This might be accomplished along the lines Mr. Pirko suggests by changing the instruction at D12 so that it reads

```
D12:  OR    BH,BH
      JS    D14
      MOV   BH, BL
```

The special case to which Mr. Pirko refers occurs when the result of an operation is positive 2^−128. It does not occur when the result is negative. The extra testing that would be required to flag this special case as underflow is probably not worthwhile.

—Robert Gray

I have always been very interested in implementations of floating-point arithmetic and so turned straight to Robert Gray's article, "Significant Figures, I"

when I received my October issue. One comment Dr. Gray made while introducing his program listing struck me as odd, prompting this letter. He wrote that "this routine is about 20 percent shorter and, presumably, proportionately faster than the routine used in the IBM PC BASIC compiler." During a year spent working at Microsoft, I wrote most all of the 8086 BASIC compiler library that did not relate to input/output. Indeed, Dr. Gray's routine is about 20 percent shorter than mine.

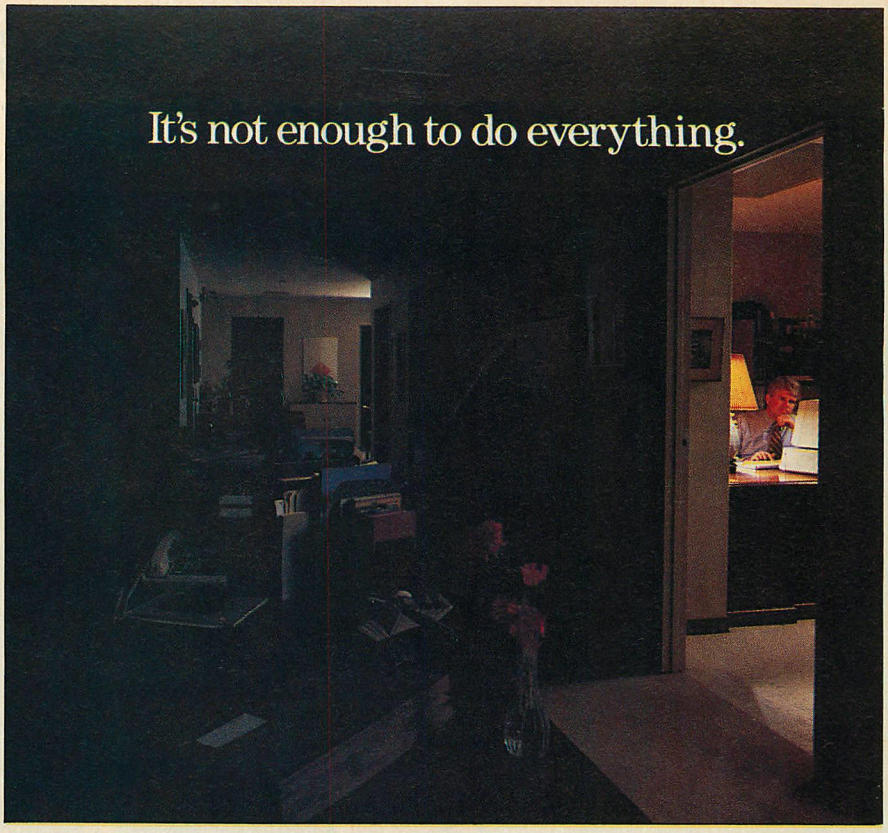
Basically, my routine is bigger because it was written for maximum speed. If it had been compiled from, say Pascal, it would indeed make sense to assume that the smaller, the faster.

Let me compare certain portions of my routine to Dr. Gray's to show how I have speeded it up. The first difference is operand alignment. His routine starts with byte shifts, then cleans up with up to seven 1-bit shifts. This is certainly a big improvement over pure 1-bit shifting—up to 24 of them.

My routine first checks for word (16-bit) shifts, then byte shifts, then bit shifts. Besides simply meaning fewer shifting operations, another advantage of this approach in the single-precision version is that the word and byte shifts can happen, at most, once, so no looping is involved. This means fewer jump instructions are executed, which are the slowest instructions in either routine.

In another level of performance optimization, my routine allows the word and byte shifts to go up to two bits too far; for example, a word shift is performed even if we are only 14 bits out of alignment. Then a separate bit-shift sequence corrects this by shifting left up two bits. This means that there are never more than five (as opposed to seven) bit shifts to perform, thereby bringing the average number of bit shifts over a random distribution of numbers to 2.25 instead of 3.5.

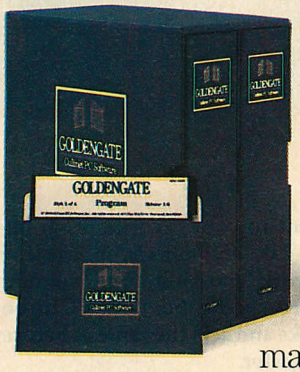
A significant coding optimization I notice is in the way the operands are carried in registers. Including sticky bit, the operand Dr. Gray is shifting is spread out over three byte registers and one word register, while mine is held in two word registers. It may seem that the penalty for using four shift instructions instead of two is very small, since they are listed in Intel documentation as requiring only two clocks to execute. However, due to a lack of the rather slow memory reference instructions in these routines, the prefetch queue has no opportunity to fill up (which normally happens during effective address calculation). The poor 8088 micropro-



You have to do everything well.

Those who succeed in business are those who consistently demonstrate a high level of skill in a variety of areas. In forecasting, in planning, in implementing, in managing.

GOLDENGATE™ is a business tool that can help you perform your best in each.



A product of Cullinet, the recognized leader in mainframe software, GOLDENGATE is a functionally rich integrated pc package. It combines spreadsheet database, word processing, graphics and telecommunications capabilities. And in combination with our IDB mainframe software, it also provides micro-to-mainframe integration that makes accessing corporate data indistinguishable from accessing data on a diskette.

GOLDENGATE's superior functionality results from its unique architecture. Each function in the program is designed to provide an optimum working environment. And each is linked to the others through core software.

The result is integrated pc software that does each of its jobs exceptionally well, so you can do the same in yours.

For more information about GOLDENGATE, phone Cullinet toll-free, 1-800-551-4555.

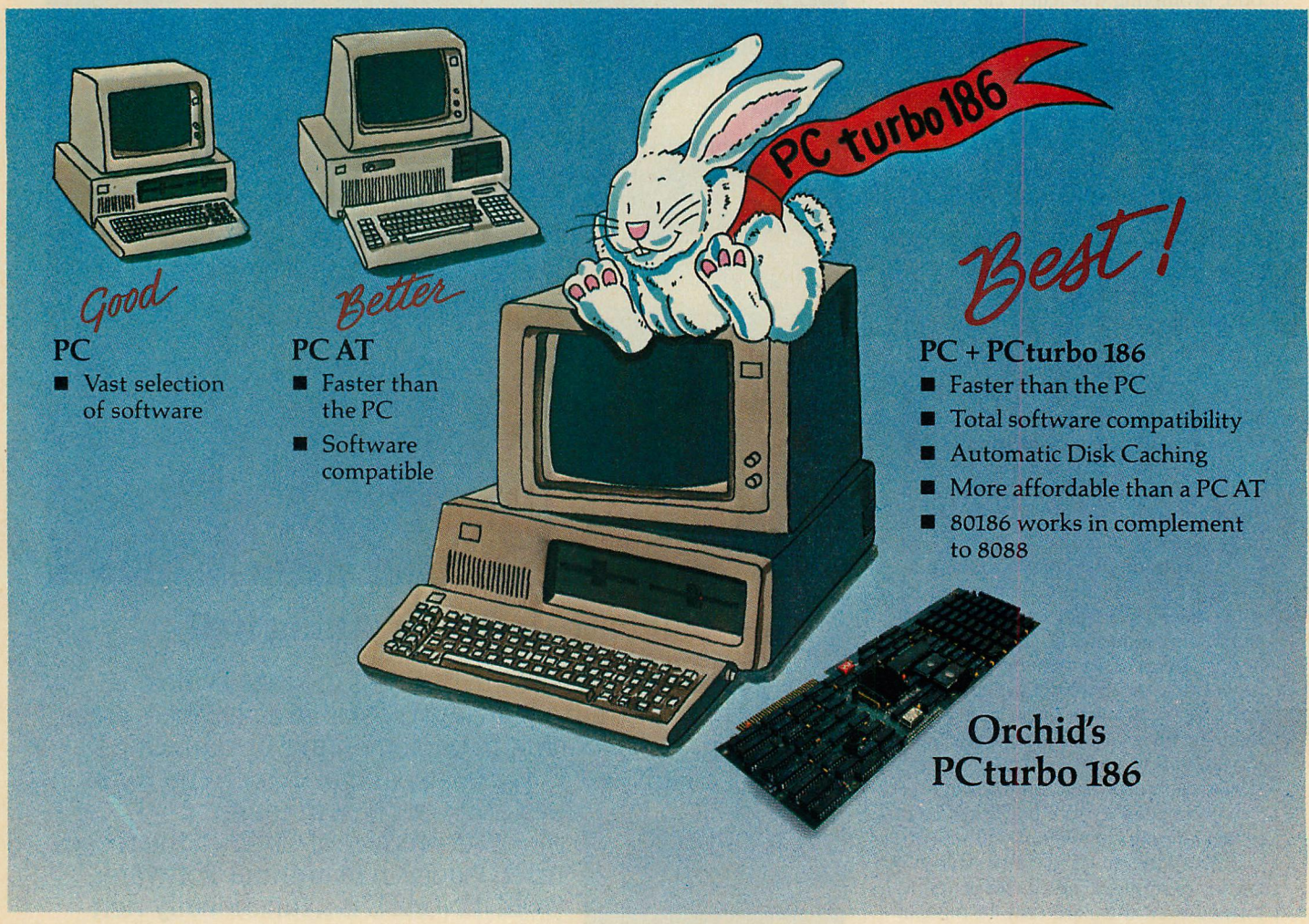
Cullinet

We understand business better than any software company in business.

© 1984 Cullinet Software, Inc., Westwood, MA 02090-2198
GOLDENGATE is a trademark of Cullinet Software, Inc.

CIRCLE NO. 199 ON READER SERVICE CARD

The PCturbo 186™ takes a good computer and makes it the **BEST!**



PC
- Vast selection of software

PC AT
- Faster than the PC
- Software compatible

PC + PCturbo 186
- Faster than the PC
- Total software compatibility
- Automatic Disk Caching
- More affordable than a PC AT
- 80186 works in complement to 8088

Orchid's PCturbo 186

First the standard was the IBM™ PC. Then it became the IBM PC AT with it's high processing speed. For those, however, who have an IBM PC and need PC AT-like performance, Orchid Technology will put you out in front again with a new standard—the PCturbo 186. The PCturbo out performs the PC AT in speed with fast disk access, and unmatched performance while providing **complete software compatibility.**

Best of all, PCturbo allows you to protect your existing hardware and software investment without the cost of replacing your existing PC or the need to learn to use a new computer and its software. **Simply install the PCturbo adapter board and Orchid's "Productivity Software" and your PC becomes a powerful turbo-driven computer.**

The PCturbo 186 is actually a second computer within your PC. Powered by the advanced Intel 80186 processor, the PCturbo is transparent to your favorite programs like Lotus 1-2-3,™ Symphony,™ dBase II or III,™ Framework™ and Multimate,™ running them at turbo speeds. **So, with PCturbo, your PC looks and acts the same as before; it just runs faster.**

While the PCturbo is speeding up your processing power the 8088 microprocessor in your PC takes care of the I/O functions. Most importantly, complete compatibility is assured since the PCturbo allows you to switch back and forth between Turbo Mode and PC Mode with a simple command.

Since PCturbo boosts the processing speed of your PC, there's no more waiting to recalculate spreadsheets or to retrieve data. With the unique built-in features like automatic disk caching, electronic RAM disks and print spooling, you can get even more done in less time. **Now isn't that why you bought a PC in the first place?**

TECHNICAL DETAILS:

Hardware
- Single slot plug-in board with high-speed 16-bit processor (80186).
- Up to 640K memory expansion for a maximum of 1.28 Megabytes total memory.
- Simple "one-step" installation.

Software
- Runs IBM PC-DOS 2.x/3.x on either the IBM PC/XT and versions of most compatibles.
- Provides high speed disk caching, RAM disk and print spooling.
- Standard PC (8088) operation for total compatibility.

Write or call for more information today.

ORCHID

ORCHID TECHNOLOGY
47790 Westinghouse Drive
Fremont, CA 94539
(415) 490-8586 Telex: 709289

PCturbo 186 is a trademark of Orchid Technology. IBM is a registered trademark of International Business Machines Corporation. Lotus 1-2-3 and Symphony are trademarks of Lotus Development Corporation. dBase II, dBase III, and Framework are trademarks of Ashton-Tate. Multimate is a trademark of Multimate International.

CIRCLE NO. 227 ON READER SERVICE CARD

cessor will be totally bandwidth-limited, which basically means instructions will require at least four clocks per byte to execute. Thus, the shift or move instructions will typically take eight clocks, not two. I estimate that Dr. Gray's bit-shift sequence will require 102 clocks per loop, as opposed to 54 for mine—an improvement of nearly two-to-one.

The relative performance of the normalize sequence in each of our routines is similar to that of the alignment sequence. Neither of us went to the same lengths to optimize normalization, since long normalizations are very unlikely. Mine still does word shift, then byte shift, then bit shift, but will never "over-shift" and back up. I consider Dr. Gray's routine to be very slow in those rare situations where you must do 23 one-bit shifts in a loop that is probably 35-percent slower than mine.

One feature about Dr. Gray's routine that I think I like is the complete testing for largest operand. My routine compares only the exponents and needs a couple of extra lines to correct things when the exponents are equal and the wrong mantissa is larger. What is particularly appealing to me in Dr. Gray's approach is the quick determination of a subtraction to 0, which could happen frequently when floating-point numbers are used as loop control variables in the main program.

Program performance is entirely determined by loop performance; after all, if programs did not loop, they could never take more than a few seconds to execute. I have examined the relative performance of the loops in our routines and on that basis would guess that Dr. Gray's takes at least 50-percent longer to execute than mine over a reasonable distribution of operands. Don't assume shorter is faster.

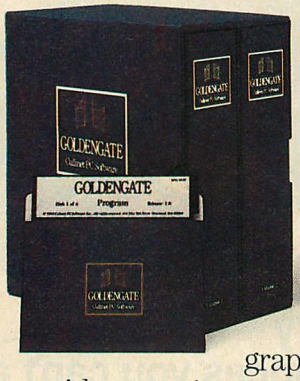
Tim Paterson
Kent, WA

Mr. Paterson takes exception to my inference that my addition routine would presumably be faster than the BASIC compiler routine that he wrote. Let me apologize for any misunderstanding. My claim was not that my routine was faster; I could not, after all, have made such a claim without actually testing the two routines very thoroughly. Other things being equal, however, the shorter routine can be expected to be faster, and this is all that I intended to claim. What Mr. Paterson points out is that, as usual, other things are not equal.

For that reason I am glad that the misunderstanding occurred since it provoked him into describing the optimiza-

We're Cullinet, the acknowledged leader in mainframe software. Our customers include some 2,000 of the world's biggest and best-run companies.

So when we set out to develop a superior integrated *personal computer* software package, we didn't have to guess what business wanted. We simply had to ask.



The combination of our technical skills and business experience and the input and feedback of our client community has resulted in GOLDENGATE,™ integrated pc software for business people intent on doing business, not fussing with software programs.

Each GOLDENGATE function—spreadsheet, database, word processing, graphics and telecommunications—is designed to provide an optimum working environment. And as powerful as the program is, specific attention was paid to making GOLDENGATE truly easy to use.

The fact is, anyone can begin to use GOLDENGATE in a matter of minutes. A single command set operates every function, so a GOLDENGATE user enjoys a single learning experience, rather than several. Tutorials and complete on-line help screens allow the novice to become productive *without training.*

To top it off, GOLDENGATE—in combination with our IDB mainframe software—provides micro-to-mainframe integration that makes accessing corporate data indistinguishable from accessing data on a diskette.

For more information about GOLDENGATE, phone Cullinet toll-free, 1-800-551-4555.

Cullinet

We understand business better than any software company in business.

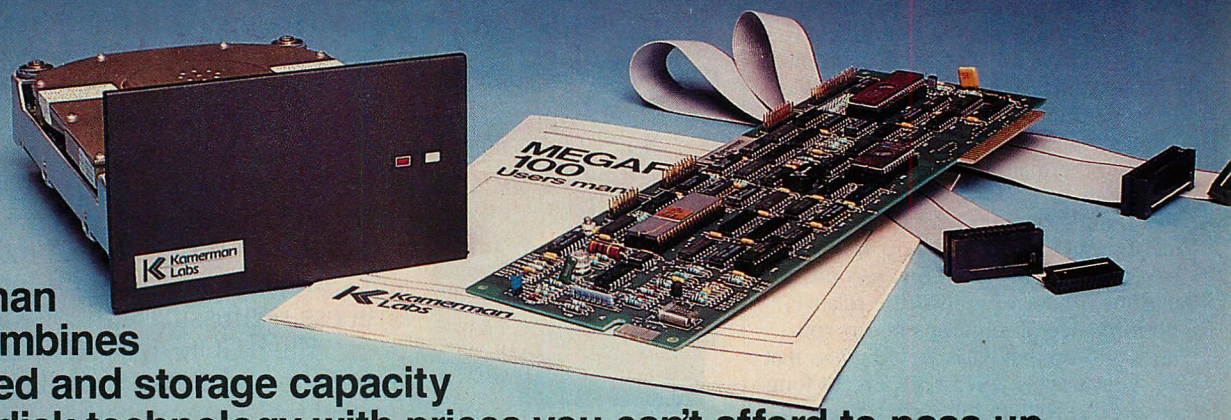
© 1984 Cullinet Software, Inc., Westwood, MA 02090-2198. GOLDENGATE is a trademark of Cullinet Software, Inc. IBM and XT are registered trademarks of International Business Machines, Inc.

CIRCLE NO. 200 ON READER SERVICE CARD

FOR THE IBM® PC, IBM® XT, COMPAQ,™
CORONA,™ CORONA™ PORTABLE, LEADING EDGE,® EAGLE PC,® TAVA.™

10 Mbyte Hard Disk System

~~$895~~ $695



Kamerman Labs combines the speed and storage capacity of hard disk technology with prices you can't afford to pass up.

A dramatic leap in performance for your personal computer.

Even the smallest Kamerman Labs hard disk unit gives you 30 times the storage capacity of a typical floppy disk. Sophisticated business and professional data storage requirements can now be handled with ease.

Better yet, you can access data up to 10 times faster than with floppies. Spend more time working and less time waiting.

And it's easy to use. Kamerman Labs lets you boot directly off the hard disk, just like the IBM XT.

A complete backup solution.

Backup of hard disk data is a critical requirement in many microcomputer applications, so Kamerman Labs offers several reliable and cost-effective backup devices that are fully compatible with our hard disk units.

Lower prices than ever.

Because you deal directly with Kamerman Labs, we offer you remarkably low prices. Finally, you can realize the full benefits of hard disk technology without the excessive costs.

Tested and formatted.

All Kamerman Labs systems have been thoroughly tested and formatted before delivery.

Full warranty and technical support.

Kamerman Labs backs all its products with a full one-year warranty on both parts and labor. Plus you get prompt technical support through a toll-free hotline number.

To order, call toll-free 800-522-2237.

In Oregon, Hawaii and Alaska call **503-626-6877.**

IBM is a registered trademark of International Business Machines Corp.
Compaq is a trademark of Compaq Computer Corp.
Corona is a trademark of Corona Data Systems.

Leading Edge is a registered trademark of Leading Edge Products, Inc.
Eagle is a registered trademark of Eagle Computers.
TAVA is a trademark of TAVA Corporation.

All Kamerman Labs Units come in either internal or external configurations.

Kamerman Labs

8054 S.W. Nimbus, Bldg. 6, Beaverton, Or 97005
Phone 503-626-6877

CIRCLE NO. 237 ON READER SERVICE CARD

tion techniques he used in his own addition routine. I am not sure that the word shift would by itself save all that much. I had myself considered and rejected this technique, reasoning that a word shift will occur essentially when the two operands differ by a factor of at least 2^16, whereas the addition and subtraction of such widely different numbers would be a relatively infrequent occurrence in most general applications. I did not check the literature on the distribution of floating-point numbers to confirm this and could, of course, be wrong. On the other hand, I particularly like Mr. Paterson's technique of overshifting during alignment and would use it myself if I were ever to write such a routine again.

—Robert Gray

A BUG IN A PATCH

I typed the IBM patch for DOS 2.1 given in "Patching a Bug in DOS 2.1," (Don Awalt, November 1984, p. 71) and found the following differences. Your listing of the patch to change the sixth instance in IBMDOS.COM read differently than mine. When I typed in the path with DEBUG, it read

```
-A409B
XXXX:409B MOV AX,CS
XXXX:409D MOV SS,AX
XXXX:409F  MOV SP,4235
XXXX:40A2 [ENTER]
```

Did someone leave out an instruction to cause this difference in the locations?

Gary Hermanson
Albany, NY

The addresses in our listing were incorrect. Your patching sequence is how it should read when displayed by DEBUG.

—WF

WORD FOR THE DAY

"We have been unbashed in publishing these corrections" ("Credibility Gap," Letters, November 1984, p. 14).

Unbashed?

Melody Covington
Athens, GA

Unbashed, not smashed? Try unabashed, not ashamed. When you cover errors, more creep in.

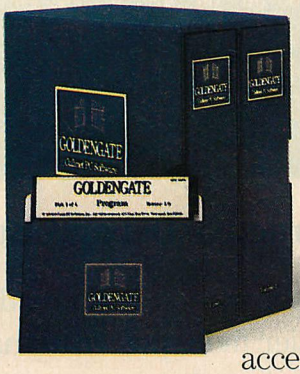
Like your Journal.

Richard Bassler
Washington, DC

Unbashed / adj: forthrightly admitting your mistakes.

—WF

Managers know that a critical decision is only as timely as the information that goes into making it. The promise of personal computers has always been to deliver information to corporate managers in time to act upon it.



Only one software company can make a claim for integrating the two things that deliver that promise: the mainframe, from which all information flows, and the microcomputer, where someone has to make sense of that information.

GOLDENGATE™ from Cullinet is not only an exceptional integrated software package. In combination with our Information Database (IDB), it creates an environment for the corporate pc user which makes accessing information in the company mainframe *indistinguishable* from accessing information on a diskette.

The benefits are obvious: "what-if's" on live data, reports that are current as of this moment, and most important, the ability to act on today's problems today. And all accomplished independently right at the pc.

Cullinet is the recognized leader in mainframe software, which makes the introduction of GOLDENGATE significant. The singular ability of GOLDENGATE to provide easy-to-use, yet sophisticated, micro-mainframe integration makes it as timely as today's news.

For more information about GOLDENGATE, phone Cullinet toll-free, 1-800-551-4555.

Cullinet

We understand business better than any software company in business.

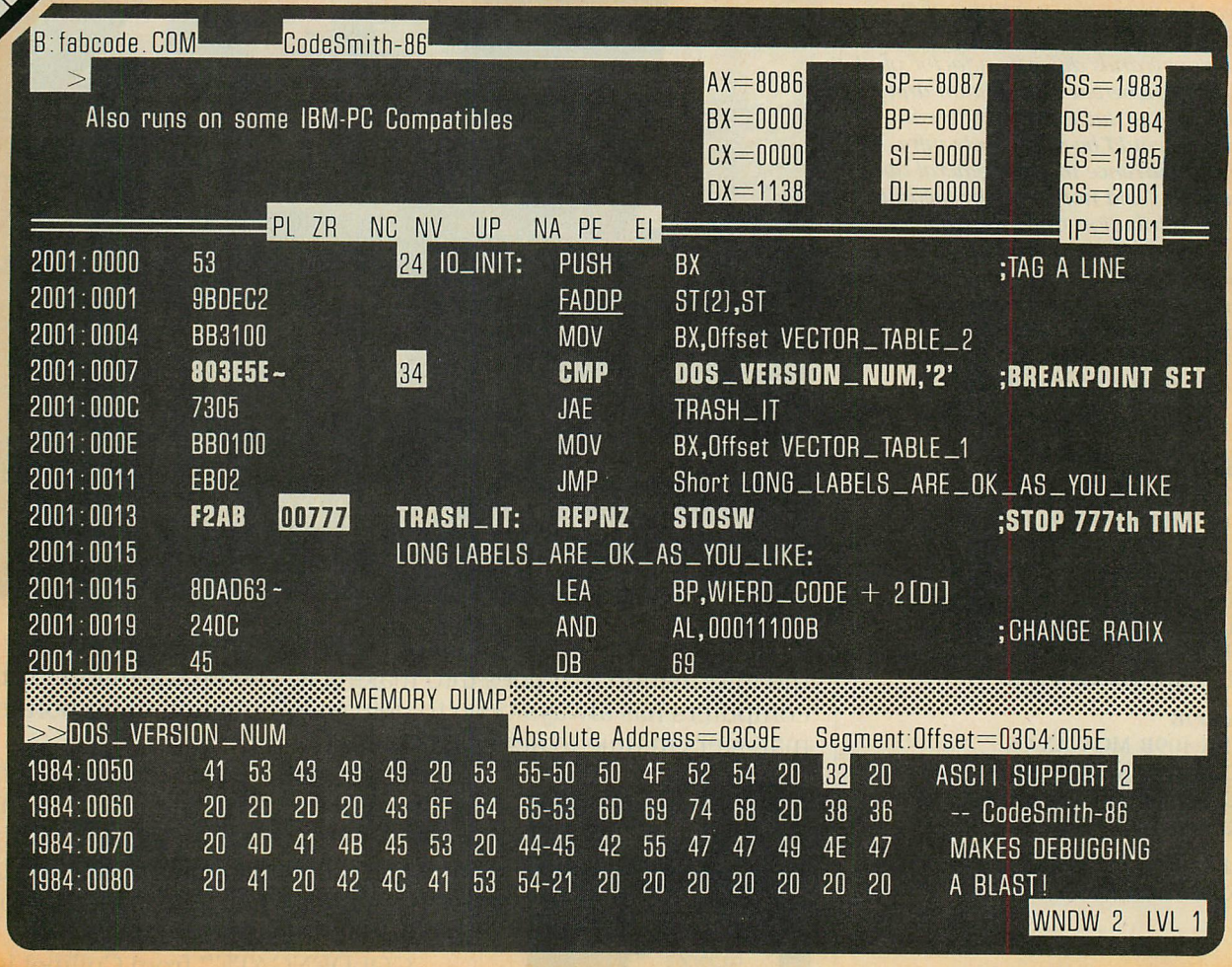
© 1984 Cullinet Software, Inc., Westwood, MA 02090-2198. GOLDENGATE is a trademark of Cullinet Software, Inc. IBM and XT are registered trademarks of International Business Machines, Inc.

CIRCLE NO. 198 ON READER SERVICE CARD

IBM-PC SYMBOLIC DEBUGGER

New Release 1.8 – SOLID GOLD

CodeSmith™-86



It's here—THE Multi-Window Interactive Debugger that's STATE-OF-THE-ART.

- Scroll Up/Down thru full-screen disassemblies & memory dumps
- **Load** and **Write** Commands much easier, more powerful than DEBUG's
- "Snapshot" a complete debugging state onto disk—resume later
- True passpoints and execution path counters
- SCREENSAVE mode saves and restores user's graphic display when breakpoint hit
- Disassemble selected ranges of memory code to disk—compatible with IBM Assembler
- Stop on data Read/Write or memory range access

Hot-Line technical support

The Professional's Choice—CodeSmith-86

Multiple copies purchased by:
Lotus Development Corp., MicroPro, VisiCorp, IBM.

Requires MS-DOS & 160K RAM.

OEM and dealer inquiries invited.

Send ___ **VISUAL AGE** **CodeSmith-86** @ $145 + $4 shipping (each) • 642 N. Larchmont Blvd. L.A., CA 90004 • (213) 439-2414 • California residents add 6.5% sales tax.

Name _____
Company _____
Address _____
City _____ State ___ Zip ___ Phone # _____
Acct. No. _____
Exp. Date _____
☐ VISA ☐ MasterCard
☐ Payment Enclosed
☐ COD

VISUAL AGE
642 N. Larchmont Blvd. • Los Angeles, CA 90004

CIRCLE NO. 221 ON READER SERVICE CARD

CodeSmith, TM International Arrangements, Inc.
MS, TM Microsoft Corp.
IBM, TM International Business Machines Corp.

CALL (213) 439-2414

$145.00

Available for IBM PC

What C did for Programming
Mark Williams has done for C Programming

The C Programming System from Mark Williams

MWC86 gets your C programs running faster and uses less memory space than any other compiler on the market. Then *csd*, Mark Williams' revolutionary C Source Debugger, helps you debug faster. That's The C Programming System from Mark Williams Company.

MWC86

MWC86 is the most highly optimized C compiler available anywhere for the DOS and 8086 environment. The benchmarks prove it! They show MWC86 is unmatched in speed and code density.

MWC86 supports large and small models of compilation, the 8087 math coprocessor and DOS 2.0 pathnames. The compiler features common code elimination, peephole optimization and register variables. It includes the most complete libraries. Unlike its competition, MWC86 supports the full C language including recent extensions such as the Berkeley structure rules, voids, enumerated data types, UNIX* I/O calls and structure assignments.

Quality is why Intel, DEC and Wang chose to distribute MWC86. These industry leaders looked and compared and found Mark Williams to be best.

User Friendly

MWC86 is the easiest to use of all compilers. One command runs all phases from pre-processor to assembler and linker. MWC86 eliminates the need to search for error messages in the back of a manual. All error messages appear on the screen in English.

A recent review of MWC86 in *PC World*, June, 1984, summed it up:

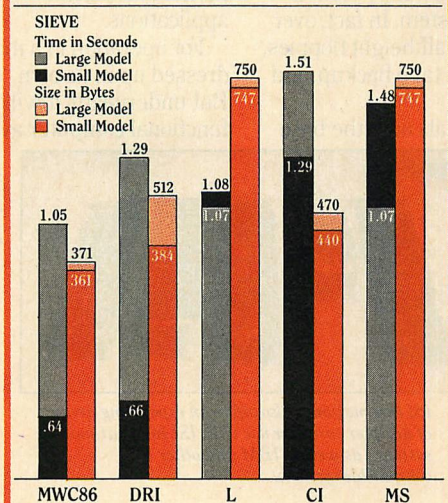
"Of all the compilers reviewed, MWC86 would be my first choice for product development. It compiles quickly, produces superior error messages, and generates quick, compact object code. The library is small and fast and closely follows the industry standard for C libraries."

csd C Source Debugger

Mark Williams was not content to write the best C compiler on the market. To advance the state of the art in software development, Mark Williams wrote *csd*.

csd C Source Debugger serves as a microscope on the program. Any C expression can be entered and evaluated. With *csd* a programmer can set tracepoints on variables and expressions with full history capability and can single step a program to find bugs. The debugger does not affect either code size or execution time. *csd* features online help instructions; the ability to walk through the stack; the debugging of graphics programs without disturbing the program under test; and evaluation, source, program and history windows.

csd eases the most difficult part of development — debugging. Because *csd* debugs in C, not assembler, a programmer no longer has to rely on old-fashioned assembler tools, but can work as if using a C interpreter — in real time.



The C Programming System from Mark Williams now supports the following libraries:

Library	Company
Windows for C	Creative Solutions
Halo	Media Cybernetics
PHACT	PHACT Associates
The Greenleaf Functions	Greenleaf Software
Btrieve	SoftCraft

The C Programming System from Mark Williams

The C Programming System from Mark Williams delivers not only the best C compiler for the 8086 but also the only C source level debugger. That's why it does for C programming what C did for programming. The Mark Williams C Programming System gives the programmer the MWC86 C compiler and the *csd* C Source Debugger for only $495. Order today by calling 1-800-MWC-1700. Major credit cards accepted.

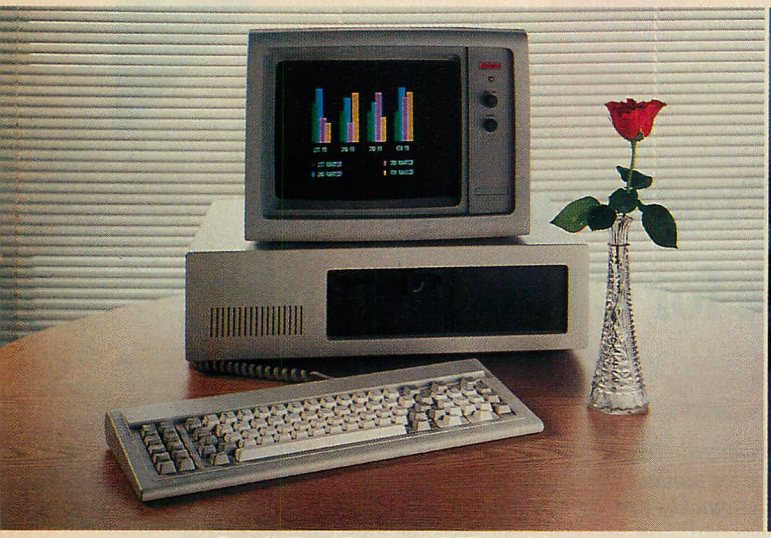
Technical support for The Mark Williams C Programming System is provided free of charge by the team that developed it.

Mark Williams Company
1430 W. Wrightwood Ave.
Chicago, IL 60614

CIRCLE NO. 186 ON READER SERVICE CARD

*Unix is a Trademark of Bell Laboratories.

Introducing the PC alternatives for the office and the factory.



For Office Control: ISI's 5160.

For Factory Control: ISI's 6160.

More flexible. More functional. More cost effective.

ISI International (formerly Intersil Systems) introduces two new IBM-compatible systems, one for the office and one for the factory.

Each is PC and XT-compatible in both hardware and software. But both offer significant advantages in flexibility, expandability and cost effectiveness.

Office Control: ISI's 5160.

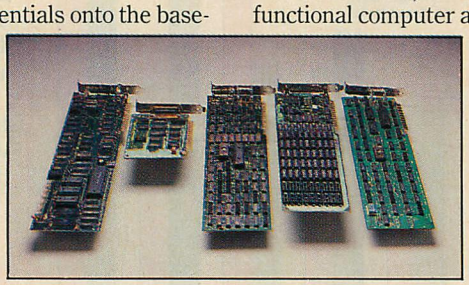
The ISI 5160 office system looks like, and works like, the PC/XT, and it will run the software its more expensive counterpart will run. So you are assured of broad software availability.

But ISI designed the 5160 to be especially flexible in meeting the needs of different sized offices, with differing (and changing) processing requirements.

Expanding all the way from a single floppy to a fully loaded Winchester system is far easier with the ISI system. In fact, over 60 MB of on-line storage capacity is available. Half-height floppies, 10, 20 and 30 MB Winchester drives, cartridge tape backup, and a 130-watt power supply supports expansion.

The first step was to put all the CPU essentials onto the baseboard, leaving more open expansion slots and greater provision to meet users' changing needs. The standard 5160 system includes all these essential features on the baseboard: 8088 CPU and optional 8087 coprocessor; 128K memory (expandable to 640K); calendar/real-time clock with battery backup; two RS-232C ports; parallel printer port; floppy disk controller and SASI interface.

So for an office system that truly offers room to grow, choose ISI International's 5160 office system.



ISI International also offers an expanding array of adapter cards for use with ISI International systems, as well as IBM and other PC-compatible systems.

Factory Control: ISI's 6160.

The ISI 6160 is essentially the same easily expandable processor as the 5160, featuring the same PC and XT-compatibility, but with important additional features that make this the ideal system for factory applications.

For example, it's 19″ rack-mountable RETMA enclosure is ruggedly designed and manufactured, and features fan cooling with positive airflow to eliminate hot spots; changeable filters for extra protection from contamination; and a key-lockable cover for limited access to power and reset switches, as well as to the shock-mounted disk drives.

Both the 5160 and the 6160 offer MS-DOS* and GW-Basic;* in addition, the 6160 factory system offers VRTX†, a multitasking kernel that permits you to run real-time, interrupt-driven control applications.

For operation in a more office-like setting, the 6160 can be dressed up in its own "office" style cabinet, just like the 5160. But underneath, it will still be the most versatile, expandable, functional computer available to run factory control applications.

For more information on either the ISI 5160 office system or the ISI 6160 factory system, call us in the West at (408) 743-4442, in the East at (201) 272-3920, or in the Midwest at (513) 890-6450.

ISI
INTERNATIONAL
1275 Hammerwood Avenue
Sunnyvale, California 94089, (408) 743-4442
European headquarters, Paris (1) 878.42.25.

*MS-DOS and GW are trademarks of Microsoft Corporation.
†VRTX is a registered trademark of Hunter & Ready, Inc.

CIRCLE NO. 157 ON READER SERVICE CARD

How Can You Avoid Getting Trapped Under An Ancient Word Processor?

Buy Word Perfect!

Once upon a time, word processors were monstrous things. Dot commands, page orientation, and separate editing, formatting and printing programs turned them into lumbering beasts. Only a well-educated programmer would dare don his armor and tackle such a beast — not a pleasant task for a modern secretary, executive, or writer.

Then came WordPerfect and the beast was slain.

WordPerfect was designed to work for you not against you. WordPerfect has no command language to complicate your writing. Pressing a single key is all it takes to

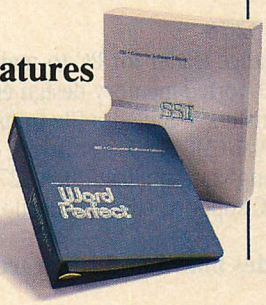
bold, underline or center.

When writing, you don't want to worry about page formatting, making room for headers or footers, or whether you are in "edit" or "create" mode. Your word processor should do it automatically and WordPerfect does. WordPerfect lets you think in terms of ideas, not pages. It is simple enough that you quickly forget about the mechanics and your writing flows easily.

So if you don't want to be caught under a word processing monster, try WordPerfect. We're certain it will improve the quality of your writing.

WordPerfect

You'll love it — not only for the features we've built in, but also for the antiquities we've left out.



SATELLITE SOFTWARE INTERNATIONAL

288 WEST CENTER STREET, OREM, UTAH 84057 (801) 224-4000 TELEX 820-618

SSI

CIRCLE NO. 236 ON READER SERVICE CARD

The best IDEA

We're IDEA. The best IDEA since the IBM PC. We have a full line of peripherals that are compatible with the IBM PC. But, more importantly, they're compatible with each other.

The Product Integration IDEA

If you try combining lots of different companies' pieces into one system, you'll discover that the pieces don't fit. Combining one company's boards with another's disk drives and still another's network can cause you a lot of aggravation. And besides, who do you call for support?

With IDEA, you won't have these problems. We develop our product line in-house and design the *pieces* to work with one another. We guarantee *it*. And more importantly, we support it.

Quality IDEAs

Every IDEA product is subjected to rigorous testing.

IDEAmax 384

The Multifunction Card with the unique backplane

• Serial, parallel and game ports cabled directly from the back of the board. • Up to 384KB of parity checked memory. • Includes disk emulation, printer spooler, printer selector, perpetual calendar and diagnostic software. • IDEA multifunction family includes IDEAmini I/O card, IDEAplus disk host adapter card. • Purchase only as many options as you need.

From $269

IDEAcomm 1200

Internal modem for 300/1200 baud communications

• Slim profile construction uses only one slot in the IBM PC or IBM PC/XT. • Easy-to-use, menu driven software for your communications applications. • Runs Smartcom®, Crosstalk®, PC Talk and most other software. • Extra serial port for COM1 or COM2 configuration.

$495

IDEAcomm 3278

The performance leader for PC-to-mainframe communications

• Unique dual-ported memory design enables 20 % –40 % faster file transfers. • Includes file transfer (upload/download) software for VM/CMS, TSO. • Software configurable keyboard for customizing your application. • 3278 Emulation, Bisync and SNA/SDLC support; coax connection to IBM 3274/3276 controllers.

$995 includes board and software

IBM and the IBM logo are registered trademarks of International Business Machines Corporation. IDEAmax 384, IDEAmini, IDEA Minimax, IDEAplus, IDEAcomm 3278, IDEAcomm 1200, IDEAdisk, IDEAdisk Plus, IDEAshare, IDEAnet and IDEAgraph are registered trademarks of IDEAssociates, Inc.

since the IBM PC.

Piece by piece and as a subsystem. Our one-year limited warranty on all products, even disk drives, is your assurance of quality and reliability.

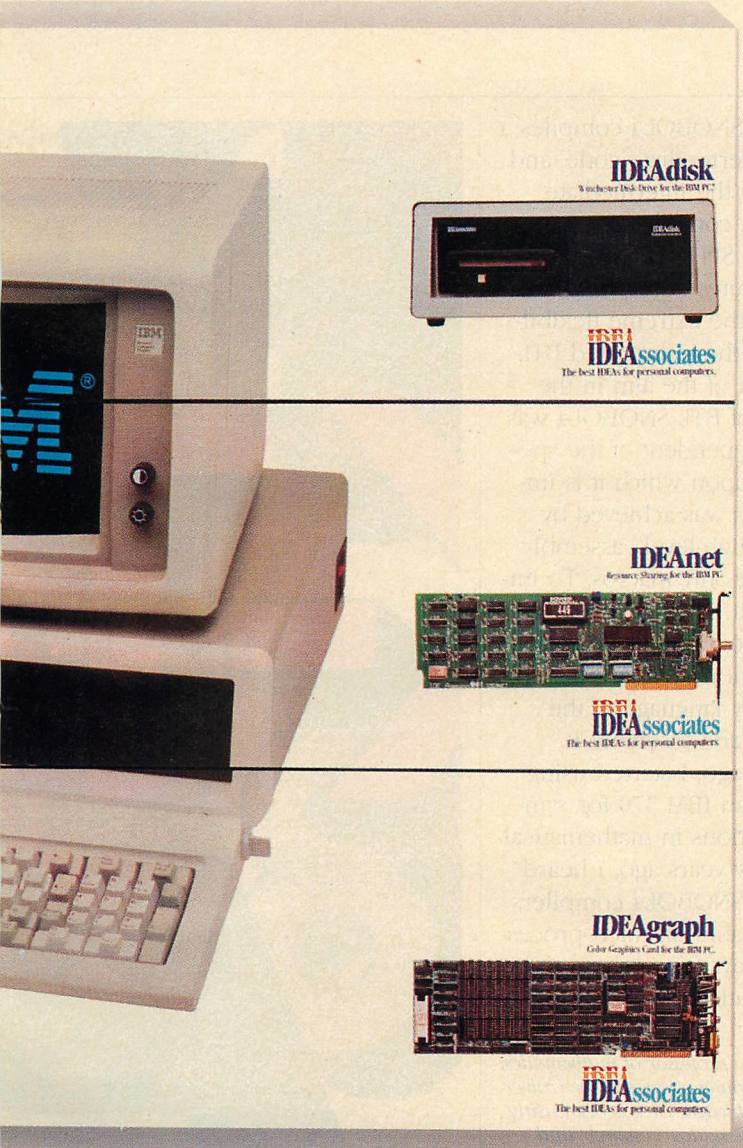
The IDEA Upgrade Plan

No matter what IDEA product you buy today, our unique buy-back policy lets you trade up tomorrow. We give you credit for your initial purchase when you're ready to upgrade your system. You only pay for what you need.

Where to Get the IDEA

You'll find IDEA products at all Math Box, Computer Depot, Amerisource, and Schaak Electronics stores, as well as many Computerland and MicroAge locations. Call **800-257-5027** for the IDEA store nearest you.

You'll see why the best IDEA *since* the IBM PC is the best IDEA *for* the IBM PC.



IDEAdisk

The high capacity disk system with built-in backup

• Removable Winchester cartridge: Faster, more reliable, easier to use than tape backup. • Wide range of storage capacities: 5, 10, 15, 25 and 45 megabytes. • Internal or external mounting versions. • Includes high performance software for disk caching, dynamic partitioning, public or private files, self booting. • **IDEAdisk Plus** version lets you add memory, serial and clock options without using another expansion slot.

From $1695

IDEAnet and IDEAshare

Cost-effective networking products for the IBM PC

• IDEAshare software for up to four users. • Fully upgradable to IDEAnet hardware and software for up to 20 users. • All PCs on the system remain fully operational. • No dedicated file server required. • Security features include User ID's, passwords, file and record locking. • Includes software for remote printing, print spooling, disk and file sharing. • IDEAnet and IDEAshare are totally integrated with IDEAdisk.

From $275 to $475 per node

IDEAgraph

High resolution, high speed color graphics card

• Transforms the IBM PC into a powerful graphics workstation for CAD/CAM, medical imaging, broadcasting, graphic arts. • 256 colors displayable at one time; up to 1024x1024 resolution. • Analog, digital TTL and composite video outputs.

From $995

IDEAssociates

The best IDEAs for personal computers.

IDEAssociates, Inc., 35 Dunham Rd., Billerica, MA 01821 (617) 275-4430 Telex 94-8245.
IDEAssociates S.A., 5, Route de Chêne, CH1207 Geneva, Switzerland (22)86.11.19 Telex 428 388 KBSCH

CIRCLE NO. 142 ON READER SERVICE CARD

SNOBOL4

A uniquely typed language that lends itself to nonnumeric applications

RICHARD LARSON

SNOBOL4 is a language designed to support sophisticated string manipulation, list processing, and other nonnumeric computations. It has been used for such purposes as symbolic computation, artificial intelligence, and compiler and assembler writing. (SNOBOL is an acronym for *StriNg Oriented* and sym*BO*lic *L*anguage; I suspect SNOBOL4's designers were making a statement about the use of such acronyms for the names of computer languages.)

The origins of SNOBOL4 date to the middle 1960s; it has been in its present form since about 1970. And, like the classic Kernighan and Ritchie book on C, a book is available that provides both an excellent introduction to SNOBOL4 and a precise and complete definition of the language (*The SNOBOL4 Programming Language*, Prentice-Hall, 1971). This book is commonly referred to as the *green book*, because of the color of its cover.

Among the implementations of SNOBOL4 on IBM mainframes are its original implementation developed at Bell Telephone Laboratories, usually called BTL SNOBOL4, and an implementation called SPITBOL. BTL SNOBOL4 compiles a program to intermediate code, and then interprets the intermediate code; SPITBOL compiles to machine code. SPITBOL produces code that executes faster, but that lacks some of the extreme flexibility allowed by the interpreted BTL SNOBOL4. Part of the aim in the development of BTL SNOBOL4 was to make it independent of the specific machine upon which it is implemented: this was achieved by writing it in "high-level" assembly language using only macros. To implement it on a new machine, therefore, a programmer need only provide definitions of these macros in the assembly language of the new machine, and assemble it.

Ten years ago, I started using SNOBOL4 on an IBM 370 for symbolic computations in mathematical research. A few years ago, I heard rumors about SNOBOL4 compilers that were available on microprocessors. But I always found them to be without foundation.

Richard Larson is a professor of mathematics, statistics, and computer science at the University of Illinois at Chicago. He has been using SNOBOL4 in mathematical research, and teaching it, since 1974.

ILLUSTRATION • DANIEL PELAVIN

Recently, several versions of SNOBOL4 have become available for the IBM PC. They include Minnesota SNOBOL4 from Berstis International; SNOBOL4+ from Catspaw, Inc.; and MACRO SPITBOL, written by Robert K. Dewar, one of the original developers of SPITBOL. Both Minnesota SNOBOL4 and SNOBOL4+ were developed from the original macro implementation of SNOBOL4. I will give a brief introduction to SNOBOL4 and provide a review of the Minnesota SNOBOL4 and the SNOBOL4+ compilers.

INSIDE SNOBOL4

Unlike some modern languages, SNOBOL4 has completely untyped variables, and lacks higher-level control structures (its only control structures are a form of the GOTO and function calls). As an example of the absence of typing, suppose a user wanted to add the string '123' to the real number 5.6, and then concatenate the string 'XYZ' with the result. This is no problem; the expression

```
'XYZ' ('123' + 5.6)
```

would have as its value the string 'XYZ128.6'. The basic principle used is that any time a string makes sense as a number, it may be used in an arithmetic expression; any time a number is used in a string expression, it is automatically converted to the appropriate string.

Although the control structures seem primitive, they do allow development of highly structured programs. The full support of function definitions, including local variables and recursion, encourages the development of programs consisting of many small functions that call other functions. In addition, SNOBOL4 has complete and flexible support for dynamic data structures: it surpasses LISP in its flexibility in this area. (A not-too-difficult exercise, which I have given students, is to write a LISP interpreter in SNOBOL4.)

The key of program control in SNOBOL4 is the notion of a statement succeeding or failing. Normally, execution of a statement succeeds. It fails, for example, if upon reading from a file an end-of-file is encountered or if a pattern matching statement (discussed shortly) fails to find an instance of the pattern in the subject string. Failure of a statement implies no moral stigma and it should not be confused with an error in the statement.

The conditional GOTO is implemented by adding :S(LABEL) or :F(LABEL) to the end of a SNOBOL4 statement. This causes a branch to LABEL if execution of the statement succeeds or fails. A two-way branch can be implemented by putting either :S(LABEL1)F(LABEL2) or :F(LABEL2)S(LABEL1) at the end of the statement. To achieve an unconditional branch, use the form :(LABEL). A label on a statement starts in column one; any unlabeled statement must begin with a blank. A SNOBOL4 program must end with a statement labeled END; the program is ended by executing this statement. In SNOBOL4, input is accomplished by asking for the value of a certain variable (often INPUT); output is accomplished by assigning a value to a certain variable (often OUTPUT). Thus, a complete program to copy the input to the output consists of

```
LOOP   OUTPUT = INPUT   :S(LOOP)
END
```

A slightly less trivial example of this procedure in SNOBOL4 would be a program written to copy one arbitrary file to another:


```
        INPUT('INLINE',1)
        OUTPUT('OUTLINE',2)
LOOP    OUTLINE = INLINE :S(LOOP)
END
```

Here the function INPUT causes the variable, the name of which is given as its first parameter, to be given a special property so that whenever its value is used, the value returned is the next line of input from the unit specified as its second parameter. (In SNOBOL4 jargon, the variable name given by the first parameter is *input-associated* to the unit given by the second parameter; the association of the unit to a specific file usually takes place during invocation of the compiler.) The function OUTPUT causes the variable name given as its first parameter to be *output-associated* to the unit specified as its second parameter.

Finally, here is a variation of this program that actually does some useful work. To test the Minnesota SNOBOL4 and SNOBOL4+ compilers, I downloaded some SNOBOL4 programs from an IBM mainframe to a microcomputer, to see how these compilers would handle them. Some of the programs were quite old, dating to the days when the standard program format was that of a punched card (the program lines were all padded to 80 characters, with the last 8 characters containing an unwanted line number). Therefore, I wanted to take only the first 72 characters of each line and remove all trailing blanks from these truncated lines. Here is the complete program I used in this exercise:

```
        INPUT('INLINE',1,72)
        OUTPUT('OUTLINE',2)
        &TRIM = 1
LOOP    OUTLINE = INLINE :S(LOOP)
END
```

Engineering Excellence

THE STATE OF THE ART IN DATA COMMUNICATIONS SOFTWARE

DESIGNED BY

MICROSTUF®

CROSSTALK IS A TRADEMARK OF MICROSTUF, INC., ATLANTA, GEORGIA

CROSSTALK IS AVAILABLE FOR MOST SMALL BUSINESS COMPUTERS

DATE 2/16/84

CIRCLE NO. 204 ON READER SERVICE CARD

This is identical to the previous program except: (1) the third parameter of the INPUT function causes input association to be done, so that the characters on each line after the number specified as the third parameter are discarded; and (2) the use of the keyword &TRIM. About three dozen keywords in SNOBOL4 have names that begin with the character "&." Some of them contain important constants. The values assigned to others control the precise nature of the computations being done. If the keyword &TRIM has a nonzero value, input operations result in strings with all trailing blanks removed.

The above program illustrates one very valuable use of SNOBOL4: the user can easily write "quick-and-dirty" programs to reformat text files in fairly sophisticated ways. (To be a bit more specific, it took about 30 seconds to write the above program. It probably would have taken one or two orders of magnitude longer to write a program to do the identical task in BASIC, C, or Pascal.)

SNOBOL4 PATTERNS

The most important, and most complex, feature of SNOBOL4 is patterns, which are used in pattern-matching statements. As an example, the statement

```
S P
```

succeeds if a string specified by the pattern P occurs as a substring of the string S; it fails otherwise. Strings can be used as patterns: they match themselves. In addition, there are built-in functions that return pattern values. The function ANY(string) returns a pattern that matches any character that occurs in the string that is its argument. The function SPAN(string) returns a pattern that matches any sequence of characters that occur in its argument. In addition, complex patterns can be built up from simple ones by concatenation (accomplished by juxtaposition, with at least one blank separating the components) and by alternation, using the operator |. For example,

```
P = ('X' | 'Y') SPAN('123')
```

assigns to P the pattern that matches strings such as X3, X31223, Y12, etc. Patterns can also be used in replacement statements, which have the form

```
S P = R
```

This statement causes the first substring of S that matches P to be replaced by the string R. Figure 1 shows a SNOBOL4 program that copies a file, replacing every number in it by the single character #.

In that program, the pattern NUM matches '+' or '−' or nothing, followed by any sequence of digits followed by a decimal point followed by any sequence of digits, or by any sequence of digits. The use of the variable NIL may be somewhat confusing; in SNOBOL4, any variable that has not been assigned a value is taken to have as its value the null string. I like to keep the variable NIL unassigned in order to have easy access to the null string, but I could just as easily have used FRED or CHARLEY.

This brief introduction barely touches the notion of patterns in SNOBOL4. The language also includes facilities to assign to variables the substrings matched by the components of patterns. It also allows recursive definitions of patterns. For example, in a few lines a pattern can be defined that matches an arbitrary algebraic expression (which is a number or a variable, or it is algebraic expressions connected by arithmetic operators). This definition translates into a SNOBOL4 pattern definition in a straightforward way.

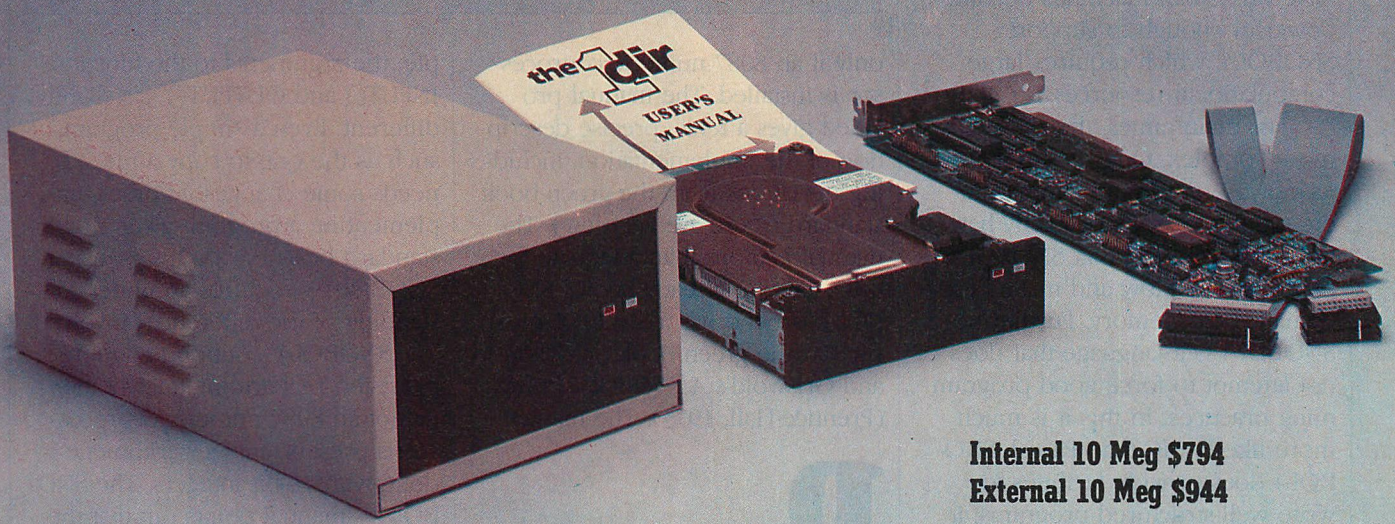
TABLES AND DYNAMICS

Another important feature of the SNOBOL4 language is the notion of a table. A table is like an array, except that instead of using an integer as an index, anything whatsoever (a string, pattern, integer, piece of compiled code, etc.) may be used. This feature is especially useful for applications such as compiler writing: by maintaining the symbol table as a table rather than an array, the user can access attributes of variable names directly, without the necessity of having to write code to search for the variable names.

SNOBOL4 also allows a program to dynamically redefine the meaning of its operators. For example, a program can call a function that causes "+" no longer to mean addition of integers and real numbers, but instead to mean the application of some exotic function to list structures. This feature is the sort that can give many compilers indigestion, so users will find that it is not always fully implemented.

The language also provides for dynamic compilation while running: a program can construct a string that contains a sequence of SNOBOL4 statements, compile it, and use the resulting code.

The Hard Disk With The Software Shell

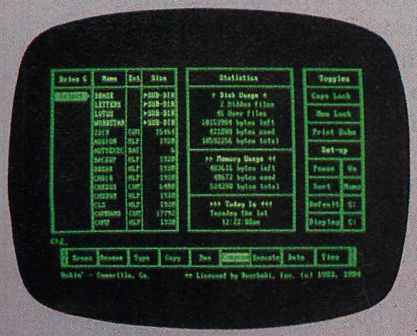


Internal 10 Meg $794
External 10 Meg $944

Why pay more for 10 or 20 Meg drives than you have to? Our 10 Meg internal hard disk subsystem is priced at $794, with the 20 Meg model going for $1288. Our external 10 Meg goes for $944, 20 Meg for $1438.

Our drives are fully compatible with any IBM PC or PC-compatible with 64K RAM and PC-DOS 2.0 or later.* Qubie' drives boot directly from the hard disk. You can power up the PC and load the system directly, without using any floppy disks. No software patches or drivers to install.

Using the same amount of power as a floppy drive, the Qubie' hard disk uses less energy than other aftermarket drives.



The drives come complete with 1dir software. 1dir's commands are in English, eliminating the need to type in DOS commands, and are all selected by using cursor control keys. 1dir even explains commands with HELP screens that give you on-line advice when you need it.

Qubie' drives are made of special plated recording media. They withstand the vibration and movement that has damaged hard disks in the past. In fact, Qubie' drives have been selected by several computer makers for use in their portable computers.

Good service starts with answering your questions before and after you buy. It continues with same or next day shipment of your order. Since we only sell a few selected products, we have the information and inventory to help you fast.

We perform repairs in our own service department within 48 hours, should you ever need service during the one year warranty period.

Our price is the whole price. All prices include UPS surface charges and insurance. In a hurry? Two day UPS air service is just $12.

Corporations, dealers and institutions, call for volume purchase price information.

*Call for information.

No Risk Guarantee
If you are not completely satisfied with your purchase, you may return it within 30 days for a full refund, including the cost to send it back. If you can get any of our competitors to give you the same guarantee, buy both and return the one you don't like.

Order Today, Shipped Tomorrow!
For fastest delivery, send cashiers check, money order, or order by credit card. Personal checks, allow 18 days to clear. California residents, add 6% sales tax.
Hours: Mon.-Fri. 8:00 a.m.-6:00 p.m. PST
Sat. 9:00 a.m.-1:00 p.m. PST

(800) 821-4479
Toll Free Outside California

(805) 987-9741
Inside California

MasterCard VISA

QUBIE'

4809 Calle Alto
Camarillo, CA 93010

London (01) 223-4569
Paris (01) 321-5316
Sydney (02) 579-3322

© Qubie' 1984

CIRCLE NO. 224 ON READER SERVICE CARD

USING SNOBOL4

One question that is probably in your mind now is: if SNOBOL4 is such a wonderful language, why isn't it more widely used? For microcomputers, the answer is very simple. Until recently, it has not been available on very small machines. (Of course, only recently have very small machines become powerful enough to support SNOBOL4, which requires large computational resources.)

For mainframes, the answer is more complex. One reason for the lack of use is certainly human inertia; other reasons probably have to do with the fact that SNOBOL4 programs are slow and make heavy demands on memory. Furthermore, SNOBOL4 is a language that does not attempt to force good programming practices. In this it is much more like BASIC than Pascal. SNOBOL4 does provide facilities to write well-structured programs; it just does not require their use.

Both Minnesota SNOBOL4 and SNOBOL4+ are derived from the original macro implementation of BTL SNOBOL4. However, there are some differences between these two versions of the language.

Minnesota SNOBOL4 is extremely close to the IBM mainframe implementation. Integer arithmetic is done with 32-bit integers. Input and output are done in the spirit of the IBM mainframe batch environment: to run the program given above, which copies a file from unit one to unit two, with the program in a file called COPY.SNO, the input in the file IN, and the output to go to the file OUT, the command line reads

```
SNOBOL4 COPY 1=IN 2=OUT
```

This version of SNOBOL4 is so close to the IBM mainframe implementation that almost all programs given in standard books on SNOBOL4 can be run absolutely unchanged. Floating-point arithmetic (single precision only) is supported only if an 8087 numeric coprocessor is installed. The manual provided gives a terse, precise description of the implementation, including deviations from the green-book standard (there are very few). The manual is more than adequate for the user who already knows SNOBOL4, or who has a SNOBOL4 text, such as the green book or Griswold and Griswold's *A SNOBOL4 Primer* (Prentice-Hall, 1973). The manual is not, and does not claim to be, an introduction to SNOBOL4. The Minnesota SNOBOL4 distribution disk includes six sample programs.

FIGURE 1: *Sample Program*

```
        DIGITS = SPAN('1234567890')
        NUM = ('+' | '-' | NIL)  (DIGITS '.' DIGITS | DIGITS)
        INPUT('INLINE',1)
        OUTPUT('OUTLINE',2)
LOOP1   LINE = INLINE   :F(END)
LOOP2   LINE NUM = '#'  :S(LOOP2)
        OUTLINE = LINE  :(LOOP1)
END
```

Both of these versions of SNOBOL4 are robust, reliable implementations of the language.

SNOBOL4+ is also an almost complete implementation of SNOBOL4. It includes many extensions of SNOBOL4, including several of the ones found in SPITBOL. Input and output support both ASCII and binary files, random access to records in files, updating files, and assigning a unit to a file by the SNOBOL4 program itself. However, this additional flexibility and power come at the cost of input and output being slightly incompatible with the green-book standard. For example, the arguments to the functions INPUT() and OUTPUT() are slightly different. Even a simple program, such as the one to copy a file, needs some changes. At times, implementing a program given in a standard book on SNOBOL4 using SNOBOL4+ requires an understanding of the differences involved.

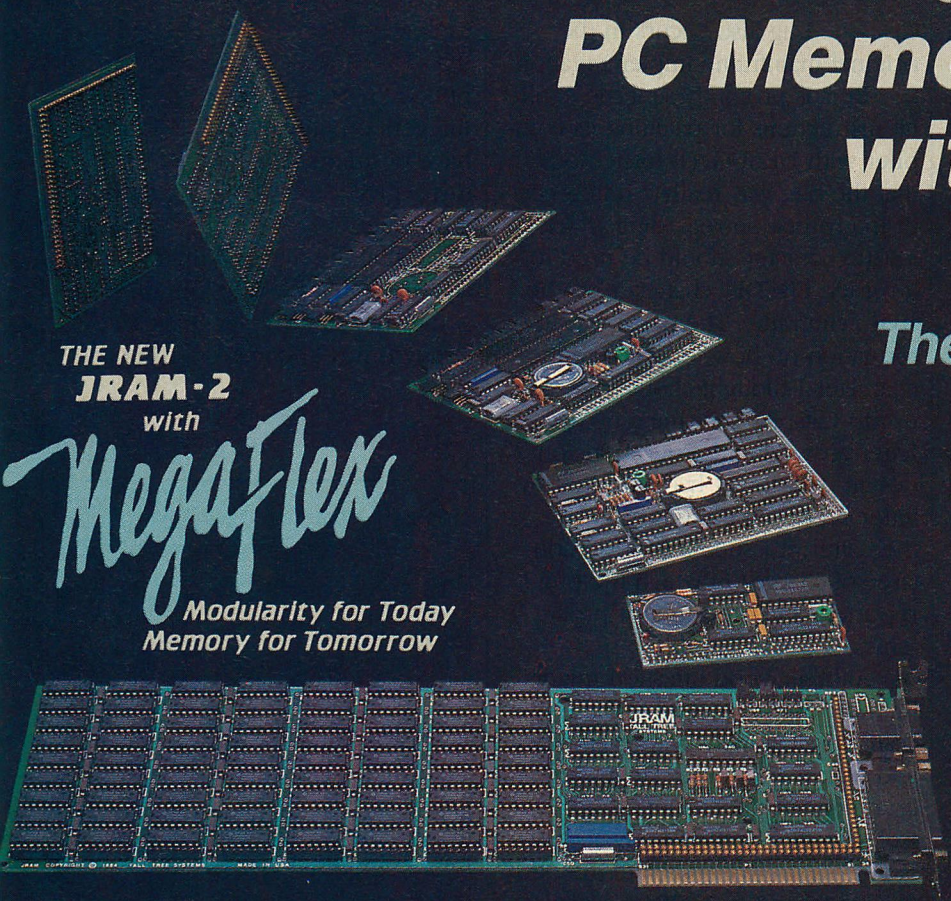
SNOBOL4+ supports double-precision real arithmetic, whether or not an 8087 numeric coprocessor is present. Integer arithmetic is done with 16-bit integers. The SNOBOL4+ manual points out that the double-precision real number format allows the exact representation of 53-bit integers. However, there are some minor problems with some of the keywords that require integer values, and occasionally some thought must be given when using a program in one of the standard books, because the author of the program had 32-bit integers in mind when he wrote it.

The manual that comes with SNOBOL4+ is very complete, although it is not a SNOBOL4 text. It includes several hints on using SNOBOL4+—such as how to implement a function to trap errors—which are useful to the advanced SNOBOL4 programmer. It also includes information on interfacing simple assembly language functions to SNOBOL4+. The distribution disk includes 39 sample programs.

TWO GOOD COMPILERS

Both of these versions of SNOBOL4 are robust, reliable implementations of the language. Each has minor bugs, although in at least one

Megaflex Your PC Memory Muscle with JRAM-2.



THE NEW
JRAM-2
with
MegaFlex
Modularity for Today
Memory for Tomorrow

The first 2 megabyte multi-function memory board for IBM PC and all 100% compatibles...

Increase your computing power with Hardware and Software solutions for PC'S and compatibles...

- **EXPAND UP TO 2 MEGABYTES PER BOARD.** Add 256K chips one bank at a time as desired.
- **MODULAR I/O PORTS – EASY TO CHANGE AND UPGRADE.** The JRAM-2, with module, fits in a single slot.
- **FINEST CONNECTOR TECHNOLOGY – NO INTERNAL CABLES.** All add-on slots are easily accessible.
- **MOST POWERFUL SYSTEMS SOFTWARE – JETDRIVE AND JSPOOL.** Unparalleled power and increased computing speed.

PURCHASE ONLY THE FUNCTIONS YOU NEED.

CHANGE MODULES AS YOU WISH.

AVAILABLE NOW:

- JRAM-2 main memory board
- JRAM-2 with Clock-Calendar
- JRAM-2 with Clock-Calendar, Serial Port, and Parallel Port
- JRAM-2 with Clock-Calendar and two Serial Ports
- JRAM-2 with two Serial Ports
- JRAM-2 with diskette controller

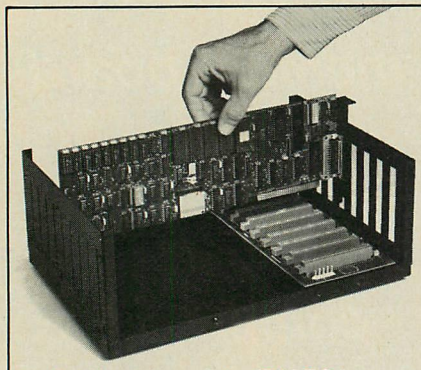
all the memory capacity you'll ever need!

1032 Elwell Court,
Suite 124
Palo Alto, CA 94303
415/964-1980

TALL TREE SYSTEMS

CIRCLE NO. 191 ON READER SERVICE CARD

NEW!
SINGLE BOARD COMPUTER
PC BUS SYSTEM

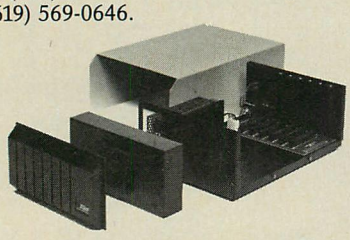


Put the power of the IBM PC into your OEM system with the new I-Bus Single Board Computer and Enclosures. Now you can make use of that vast array of PC-compatible expansion cards—for communications, graphics, data acquisition, peripheral control, and every other imaginable task.

I-Bus Systems has coupled Intel's powerful new 80188 CPU with 64K of RAM and up to 160K of on-board EPROM, plus a serial console port to talk to a terminal or a PC. Just plug the SBC into an I-Bus 6-slot chassis or 9-slot card cage and you have the heart of a computer system, ready to run.

Best of all, the IBM PC works perfectly as a software development system. You can assemble and test applications programs on the PC, then download them to the I-Bus system for dedicated execution.

For all the details, give us a call today at (800) 382-4229. In California, call (619) 569-0646.



I-BUS SYSTEMS
9235 Chesapeake Drive
San Diego, CA 92123

IBM PC is a trademark of International Business Machines

CIRCLE NO. 277 ON READER SERVICE CARD

case, the bug also occurs in the original mainframe implementation.

Berstis promptly sent me explicit instructions for patching its compiler with DEBUG. (It turned out that the bug was really a difference of interpretation regarding which ASCII character should be used for a certain EBCDIC character on the IBM mainframe. The patch was information on how to switch to the character I thought should be used.) Catspaw sent me a two-page letter answering the questions on design decisions I had asked in my letter reporting the bug. Shortly thereafter, it issued a new version (free-of-charge) in which the bug I reported, and other minor problems, had been fixed.

Another good question might be: how do the speeds of these two compilers compare with each other and with that of other languages? A crude test of the efficiency of control structures and of array accesses is a program to enumerate the odd primes from 3 to 16,383, using the Sieve of Eratosthenes (see *BYTE,* September 1981, January 1983).

Because it had a limitation on the size of objects allowed, Minnesota SNOBOL4 did not permit an array having more than 4,095 elements. Therefore, I was forced to use a reduced version of the problem, in which I enumerated the odd primes from 3 to 8,193. Table 1 displays the result of one iteration of the sieve, for both the original and reduced problems, together with the time for BASIC (using integer variables) on the IBM PC (taken from the *BYTE* article). For this benchmark, SNOBOL4+ is significantly slower than BASIC, and Minnesota SNOBOL4 is slower than SNOBOL4+. In general, Minnesota SNOBOL4 seems to take about 60 percent more time on a given program than SNOBOL4+. One exception is the program given above to truncate lines to 72 characters, and then to trim trailing blanks from each line. Minnesota SNOBOL4 took about 20 percent less time than SNOBOL4+. It also has happened on occasion that the 32-bit integers on Minnesota SNOBOL4 have permitted smaller data structures, giving it a significant speed advantage.

Using the Sieve of Eratosthenes as a benchmark for SNOBOL4 is somewhat silly: the language's strength lies in complex string and list structure operations, not in bit manipulation. I considered trying a benchmark that would reflect those abilities, but very quickly realized that writing such a program in any other language would be a major programming project. (Here is an interesting benchmark: "It takes X minutes to program and debug a solution to problem Y in language Z." I believe SNOBOL4 would really shine with such a benchmark.)

Then I got the idea of benchmarking these two compilers against mainframe implementations of SNOBOL4. The green book gives several sample programs, together with running times for given data, on an IBM 360/65 (a vintage 1970 $1-million computer). Using a program that parses statements and

TABLE 1: *Sieve of Eratosthenes*

(Execution time in seconds) Number range:	3-8,193	3-16,383
Minnesota SNOBOL4	277.7	—
SNOBOL4+	153.1	312.0
BASIC	—	199.0

TABLE 2: *Syntactic Recognizer*

(Execution time in seconds)	
SPITBOL (IBM 3081)	0.027
SNOBOL4 (IBM 3081)	0.250
SNOBOL4 (IBM 360/65)	3.594
SNOBOL4+ (IBM PC)	22.850
SNOBOL4+ (PC/AT)	8.960
Minn. SNOBOL4 (IBM PC)	36.690

recognizes whether or not they are syntactically correct SNOBOL4 statements (by constructing a complex pattern that matches all valid SNOBOL4 statements), I compared the time for these two compilers with the time required on an IBM 360/65, and the time required by BTL SNOBOL4 and SPITBOL on an IBM 3081 (a current, vintage multimillion-dollar computer). The relative performance of Minnesota SNOBOL4 and SNOBOL4+ is surprisingly good, especially considering the inefficiencies required for the 8088 to access more than 64KB of data, which both Minnesota SNOBOL4 and SNOBOL4+ do (see table 2).

Overall, how do these two compilers compare? Minnesota SNOBOL4 is somewhat slower, but is slightly closer to the original mainframe implementation. It would be especially good for learning SNOBOL4 (no problems of incompatibility of programs taken from texts), or for moving programs between a mainframe and a microcomputer. The faster SNOBOL4+ takes advantage of the microcomputer environment, but has some minor incompatibilities. SNOBOL4+ would be the choice for an experienced SNOBOL4 programmer interested in using a powerful, flexible version of SNOBOL4 on a microcomputer and who is not concerned about compatibility with a mainframe. A programmer could buy both compilers at their current prices and spend only a fraction of the cost of a BASIC or Pascal compiler.

Minnesota SNOBOL4
Berstis International
P.O. Box 441
Millwood, NY 10546
$39.95, plus shipping
CIRCLE 478 ON READER SERVICE CARD

SNOBOL4+
Catspaw, Inc.
P.O. Box 1123
Salida, CO 81201
$95.00, plus shipping
CIRCLE 477 ON READER SERVICE CARD

REFERENCES

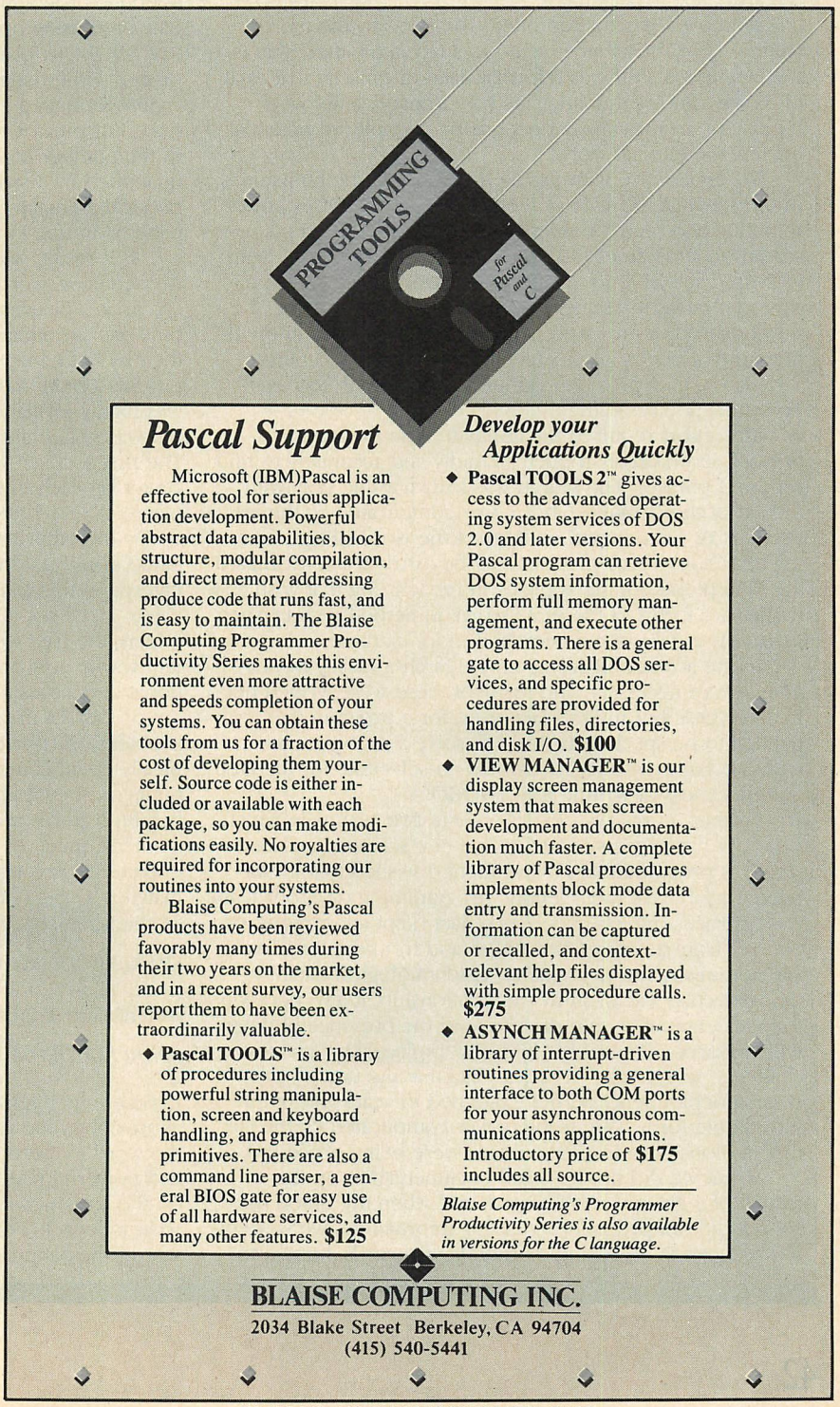
Gimpel, J.F. *Algorithms in SNOBOL4.* New York: John Wiley and Sons, 1976.

Griswold, R.E. *The Macro Implementation of SNOBOL4.* New York: Freeman and Co., 1972.

Griswold, R.E. *String and List Processing in SNOBOL4.* New York: John Wiley and Sons, 1975.

Griswold, R.E. and M.T. Griswold. *A SNOBOL4 Primer.* Englewood Cliffs: Prentice-Hall Inc., 1973.

Griswold, R.E., J.F. Poage, and I.P. Polonsky. *The SNOBOL4 Programming Language,* second edition. Englewood Cliffs: Prentice-Hall Inc., 1971.



CIRCLE NO. 115 ON READER SERVICE CARD

SNOBOL4 FOR HUMANITIES, SCIENTIFIC, AND BUSINESS PROGRAMMERS

The availability of not just one but two versions of SNOBOL4 (and one version of the SNOBOL4 dialect SPITBOL) for the PC will be exciting news for the computer scientist or mathematician who has long enjoyed its recursive powers on the mainframe. It will also be good news to the rarer community of present and former humanities scholars and linguists such as myself who are aware of SNOBOL4's capacity to process strings of characters—its ability to deal with language data rather than numeric data. While PL/1 is more popular for this purpose in the United States, in Great Britain SNOBOL4 is almost a standard language for literary and linguistic text processing.

Moreover, what is too often dismissed by the more technical SNOBOL4 afficionado as a trivial function, that is, the language's ability to reformat data—a capacity that each of us who knows the language has probably employed hundreds of times—may be a greatly unexplored potential for the commercial world.

My experience with SNOBOL4 began in the humanities, in the study of the style of literary texts. SNOBOL4's power to define and search for repeated patterns speeded my research on repetitious (formulaic) style in epic poetry. With its help, I was able to question the theory that because repeated phrases in Homer's *Iliad* and *Odyssey*, such as "the rosy-fingered dawn," were similar to such phrases in the illiterate oral poetry of nineteenth- and twentieth-century Yugoslavia, they provided evidence that Homer, too, composed his poetry orally.

This effort required the ability to scan thousands of lines of Serbo-Croatian poetry rapidly and accurately to find repeated phrases. The search was truly feasible only with the aid of the computer, but it was complicated by the inflections or grammatical endings of the words. In processing text in English a program can be instructed to disregard the final plural ending -s or -es in recognizing that wish and wishes are forms of the same word; in Serbo-Croatian, such variations are more common and more extreme.

In the actual practice of my research a variety of programs were necessary, and many of these were written not in SNOBOL4, but in PL/1. However, for a program that needed to be specially tailored to solve a problem that would occur only once, there was no substitute for the ease and quickness of writing it in SNOBOL4.

Further, in my own experience in two realms in which I did not have access to SNOBOL4, one scientific and one business programming environment, I wished that it had been available. In the scientific programming case, our team was reprocessing job experience data (kept anonymous, of course) from a major labor union and from the Social Security Administration to create an epidemiological database. Our objective was to study the relationship, if any, between the incidence of certain diseases and the presence of potentially hazardous chemicals in the workplace. Our greatest challenge was to take historical data that the union's processing department had not examined in years and put it into usable form. The problem was complicated by the fact that millions of individual records were being processed.

When we did not have full documentation on the format of a given type of record, and when the union personnel did not precisely recall this information, we were often reduced to searching thousands of records, hoping to detect significant patterns that would provide clues about how their programmers had formatted records on the membership's work patterns in that particular year. To accomplish this, we wrote lengthy and cumbersome programs in PL/1, and even when we used parameterized formatting utilities (also written in PL/1), these searches usually took days. Such custom, one-time-use programs, written to search for patterns relatively complex to define, could have been written with far greater ease and speed in SNOBOL4.

Before explaining the features of SNOBOL4 that make it a powerful tool for the solution of these humanities and scientific programming problems, let's identify a sample data processing problem in the everyday business world that SNOBOL4 could solve more readily than could COBOL or most other languages. Most business data, of course, is rigidly formatted: each record is composed of fields that are fixed in format. Even when fields are variable in length or in the number of occurrences per record, the variable is quantified by a switch, byte, or the contents of another field, rather than making demands on the program to recognize patterns in free-form data.

As a result, when less strictly formatted data, such as user-entered, word-processed data, is processed, problems can arise. For example, I recently attempted to sort, for one-time use, an organization/personnel chart by budget center, then by last name, using a mainframe word-processing product's built-in sort routine. This word-processed data was highly formatted, from a word-processing point of view, but was not all arranged in vertical, column-oriented fields. The first sort key was easy to specify, because each budget center on each line was always preceded by the same tab macro. A search argument to find this key was easy to specify. On the other hand, the other key, which was the last name, could not be specified, because the data had been entered in this format: first name, middle initial, and last name. Since not all employees in the document had middle initials, the data were inconsistent and there was no convenient way to sort on last names without requiring many additional keystrokes to enable this sort key to be located.

SNOBOL4 provides features that can easily solve such problems. Its power to reformat text, though perhaps technically trivial compared with its recursive capabilities, may be its most exploitable business use. Three particularly helpful features must be highlighted.

First, much of what SNOBOL4 does is written in terms of patterns. Second, one common pattern, called SPAN, matches a string of any length, composed of a specified set of characters, occurring in any order. For example,

```
SPAN(ABCDEFGHIJKLMNOPQRSTUVWXYZ) . WORD
```

matches any English word that is not a contraction, while

```
SPAN(ABCDEFGHIJKLMNOPQRSTUVWXYZ') . WORD
```

matches any English word, including contractions (note the apostrophe following the 'Z'). Both of these patterns assign the word to the variable WORD. Third, another common and powerful pattern, called BREAK, matches a pattern not on the basis of what it is composed of, but on the basis of what follows it. For example, in a list of unpunctuated words, the pattern

BREAK(' ') . VARIABLE SPAN(' ')

would match (that is, identify and break out or isolate from the text) each word in the list and place it in a variable, since each word is followed by a blank space, discarding the blanks in the process.

Let us return to our problem of the list of names, first name first, some with middle initials. Assume that SNOBOL4

FIGURE: *Sample Program*

PROGRAM

```
          ALPHA     = 'ABCDEFGHIJKLMNOPQRSTUVWXYZ'
          FIRSTNAME = BREAK(ALPHA) BREAK(' ') . FN
          INITIAL   = BREAK(ALPHA) BREAK('.') . IN
          LASTNAME  = BREAK(ALPHA) BREAK(' ') . LN
          WITHINIT  = FIRSTNAME INITIAL LASTNAME
          NOINIT    = FIRSTNAME LASTNAME
          &ANCHOR   = 1
          &TRIM     = 1
READIN    LINE = INPUT                                  :F(END)
          LINE WITHINIT =                               :F(NOINITIAL)
          OUTPUT = LN ',' DUPL(' ',15 - SIZE(LN)) FN
+            DUPL(' ',10 - SIZE(FN)) IN '.   ' LINE     :(READIN)
NOINITIAL LINE NOINIT =                                 :F(READIN)
          OUTPUT = LN ',' DUPL(' ',15 - SIZE(LN)) FN
+            DUPL(' ',15 - SIZE(FN)) LINE               :(READIN)
END
```

INPUT

```
Rudy S. Spraycar J77 Spaghetti Factory
Joe Blow K92 Machine Shop
Rudolph J. Spraycar K93 Management
John Q. Public A27 Governmental Relations
John Henry E33 Blacksmith Shop
John Hancock W22 Handwriting Department
```

OUTPUT

```
Spraycar,       Rudy      S.    J77 Spaghetti Factory
Blow,           Joe             K92 Machine Shop
Spraycar,       Rudolph   J.    K93 Management
Public,         John      Q.    A27 Governmental Relations
Henry,          John            E33 Blacksmith Shop
Hancock,        John            W22 Handwriting Department
```

has been told to ignore capitalization by "folding" upper-case and lower-case letters. If a pattern has been defined, consisting of all the letters of the alphabet,

ALPHA = 'ABCDEFGHIJKLMNOPQRSTUVWXYZ'

then the pattern FIRSTNAME can be defined as an alphabetical string that is terminated by a blank:

FIRSTNAME = BREAK(ALPHA) BREAK(' ') . FN

The first name is identified and assigned to the variable FN.

To continue the example, the pattern INITIAL matches a string that is terminated by a period, assigning the identified initial to the variable IN:

INITIAL = BREAK(ALPHA) BREAK('.') . IN

In this pattern, BREAK(ALPHA) matches the blank preceding the initial; in the FIRSTNAME pattern, it matches the null string. Thus, it is the pattern BREAK('.') that actually matches the initial and assigns it to the variable IN.

The pattern LASTNAME matches another string that is terminated by a blank, assigning the last name to the variable LN:

LASTNAME = BREAK(ALPHA) BREAK(' ') . LN

The pattern WITHINIT matches a name that has a middle initial:

WITHINIT = FIRSTNAME INITIAL LASTNAME

while the pattern NOINIT matches a name without a middle initial:

NOINIT = FIRSTNAME LASTNAME

These last two patterns are composites of those defined earlier; pattern-building like this adds to SNOBOL4's power.

With this data, then, in those cases when the pattern WITHINIT fails to match, the pattern NOINIT should succeed, and in either case, each element is now assigned to its own variable. This permits concatenation of these data elements back into any order, padding with any number of blanks, to produce neatly ordered fields, or positioning a sort key in a consistent columnar position within the line. The function SIZE(variable) returns the length of the string assigned to the variable, which can then be subtracted from the desired position of the next column; the function DUPL(string, number of repetitions) can then pad the variable with enough blanks to align the next output variable.

In the figure, the program would reprocess the input to produce the output. A plus in the first column is a continuation character. A label in parentheses following a colon at the right of a line is a GOTO; preceding it with :S or :F makes the branching conditional upon the success or failure of the pattern-matching in the line.

A similar approach would have aided with the preformatting problem experienced in the scientific programming example described above. SNOBOL4's flexibility also provided readily coded solutions to the need for flexibility in pattern-matching with inflectional endings in the study of the style of literature in foreign languages. As other writers have observed, SNOBOL4 allows the programmer to write very dense, unstructured, indecipherable, and unmaintainable code. As with APL, the same programmer can return to code that he or she wrote some time ago and be completely puzzled by it. Even so, and perhaps because of this, SNOBOL4 is useful for the custom, one-time-use job. Moreover, if care is taken to write explicit, well-documented programs, SNOBOL4 might well be added not only to the arsenals of humanities and scientific researchers, but also to the workbench of the current business programmer.

—RUDY S. SPRAYCAR

REFERENCES

Griswold, R.E., and M.T. Griswold, "Exotic Language of the Month Club: Discovering SNOBOL4." *Computer Language*, Premier Issue 1984: 65-68.

Spraycar, R.S., and L.F. Dunlap, "Formulaic Style in Oral and Literate Epic Poetry." *Perspectives in Computing*, IBM 1982: 24-33.

Rudy S. Spraycar is assistant superintendent in charge of training and education in the Data Processing Department at the home office of USF&G in Baltimore. He has a Ph.D. in medieval literature.

PC-AT®

The ultimate in PC performance.

Introducing Advantage! From AST.

The first and only multifunction board for your PC-AT, Advantage! lets you add millions of characters of memory capacity, two serial ports, a parallel port and a game port. All in a single expansion slot.

The Memory Advantage! Advantage! provides the extra memory you need to run sophisticated integrated software such as Framework,™ Lotus 1-2-3™ and Symphony.™ To operate multitasking programs such as IBM's TopView™ or multiuser operating systems such as XENIX.™ To handle larger amounts of data, faster. Or for RAM disks.

Our unique memory addressing technique rounds out your system board to 640K, and continues memory expansion at 1 Megabyte. You can add up to 3 Megabytes of parity checked user memory in a single slot using combinations of 64K or advanced 256K memory chips. And of course, Advantage! supports your AT's high performance bus and faster program processing speed.

The I/O Advantage! Connect printers, plotters, mice and joysticks. Add a modem to tap into CompuServe,® EasyLink,© Dow Jones® and other information networks. Or with the appropriate software, connect other terminals and create multiuser environments.

An AT compatible serial port and a parallel port are standard Advantage! features. With our optional second serial port you can attach even more peripherals,

Advantage!™

Ultimate performance enhanced.

while our optional game port lets you plug in joysticks and other cursor-control devices for business or just for fun.

The Future Advantage! Advantage! from AST means your future is open to expansion. When you use precious slot space to your best advantage, you save space for the state-of-the-art in your PC-AT's future.

The Quality Advantage! AST's reputation is built on quality products, quality support and quality service. Our complete documentation makes the Advantage! exceptionally easy to install and use, but if it's not enough we're always here to help.

The Advantage!—only from AST. It's the advantage your IBM PC-AT needs today. Call our Customer Information Center (714) 863-1333 Ext. 5249 for more information on the Advantage! multifunction board and other AST products, or the location of your nearest dealer.

AST Research, Inc., 2121 Alton Avenue, Irvine, CA 92714 TWX: 753699AST UR

FEATURES

Memory Expansion
- 128Kb to 3.0Mb in a single slot
- User Upgradeable with either 64K or 256K memory chips
- Split Memory Addressing rounds out AT's system memory to 640K and continues memory expansion at 1Mb

I/O Expansion
- Up to 2 Serial Ports (1 optional)
- Parallel Printer Port
- Optional Game Port

Advantage! Supports AT's Full Program Processing Speed

AST RESEARCH INC.

**IBM PC-AT and TopView trademarks of International Business Machines Corp. Framework trademark of Ashton-Tate. Lotus, 1-2-3 and Symphony trademarks of Lotus Development Corp. Dow Jones trademark of Dow Jones & Co., Inc. EasyLink copyright Western Union. CompuServe is a H&R Block company. XENIX trademark of Microsoft Corp. Advantage! trademark of AST Research, Inc.*

CIRCLE NO. 103 ON READER SERVICE CARD

PACKing the Date and Time

A slick DOS technique for putting a time and date stamp on data records

PATRICK FINAN

Converting the date and time to a "packed" format saves storage space and increases application speed. I often need to put a date and time stamp on data records that are written to a file.

The easiest way to do this is simply to store the familiar MM/DD/YY and HH:MM:SS formatted character strings as fields of the record; however, there are two major problems with this technique. First, each field requires eight bytes of file or memory space. The second problem involves the actual format of the string value. In an interactive application, the date could be entered as 12/7/85, 12/07/85, or even 12-7-85. This inconsistent format makes sorting and comparison of time and date values difficult.

DOS stores the date and time a file was last accessed in the disk directory by packing them into 16-bit values. There are several advantages to converting the date and time to a packed format, the main one being that less disk space on data file records is used; another advantage is that less memory is used when dynamically allocating records that contain the time and date. In addition, if the language being used supports an unsigned 16-bit value, the packed numeric representation allows for faster sorting and comparisons. This is easy in Pascal using the WORD data type, but it gets a bit more difficult in BASIC since the only 16-bit value available is a signed INTEGER.

Finally, because the year is stored as an offset from a predefined base year instead of an absolute value, problems associated with the transition from the year 1999 to the year 2000 are eliminated. If 1980 is selected as the base year, in 1999 the year component of the packed date value would be 19, while in 2000 it would be 20. Sorts and comparisons that use the packed form of the date will all function properly at the turn of the century.

THE TECHNIQUE

The two techniques used to pack and unpack the date and time are called bit masking and bit shifting. Bit masking allows the isolation of specific bits in a value, while bit shifting allows the bit pattern of a particular value to be moved to the left or right. While these techniques are typically used by assembly language programmers, most people do not realize that they can be used in higher level languages.

Suppose you were only interested in the upper four bits of a variable that had a bit representation of 1010 1100 as follows:

```
    1 0 1 0  1 1 0 0
and 1 1 1 1  0 0 0 0  (mask value)
    ---------------
    1 0 1 0  0 0 0 0
```

This shows that those bits could be isolated by ANDing the value with a "mask" that has 1s in the bit positions that are to be isolated and 0s in the other positions. The AND operation says that the result will be a 1 only if the two bits being compared are both 1. The result of this bit-by-bit comparison is 1010 0000. Remember, the value of the individual bits is important, not the magnitude of the resulting number.

Patrick Finan is a senior systems analyst, who lives in Ohio. He has a degree in electrical engineering and an MBA in finance.

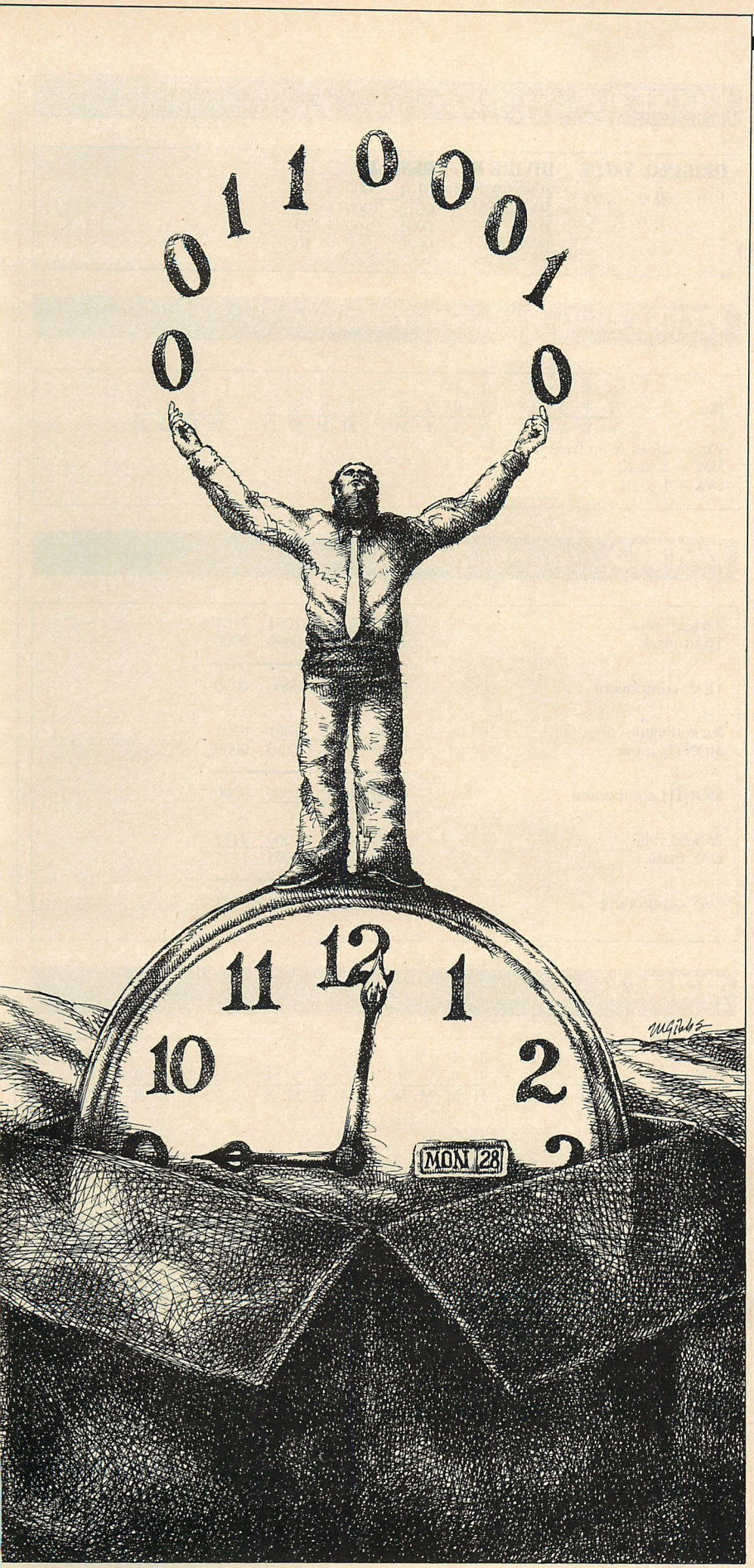


ILLUSTRATION • MICHAEL GIBBS

Once the desired bits are isolated, they can be shifted to the right to get a meaningful value for the bit pattern. Dividing the value by two has the effect of shifting the bit pattern one position to the right. In general, to shift the bit pattern n positions to the right, divide by $2n$. As may be obvious, to move the bit pattern to the left n positions, multiply by $2n$. Figure 1 shows that the value must be divided by 24 or 16 in order to shift the bit pattern four positions to the right.

PACKING THE DATE

The date can be packed into a 16-bit value (see figure 2). Note that the year is an offset from a base year (here, 1980 is used because that is the base year used by IBM). The year component of the packed value in 1985 will be a 5, since 1985 is five years from the base year. Seven bits are allocated to the year component, so the offset can range from 0 to 127 years.

The task is to convert the familiar MM/DD/YY representation of the date into its packed format. This is accomplished by isolating the

month, day, and year components from the string representation; converting them to numbers; and putting the resulting values in the proper positions of the packed value.

An example should illustrate the process. To convert the date 12/07/85 to a packed format, first extract the character strings for the month, day, and year and then convert them to a numeric value. As mentioned above, the year is really an offset from the base year of 1980, so 80 should be subtracted from the year value. Thus, the numeric values for each component are these (the 5 indicates number of years from the base year):

```
Year  = 5   0000 0101
Month = 12  0000 1100
Day   = 7   0000 0111
```

The next step is to position the significant bits of each value (as noted by the underline) in the proper positions of the packed value. This can be accomplished by shifting the bits in each value the proper number of times and adding the results together. Because the month occupies bits 5 through 8 in the packed value, multiply the month by 25 or 32 to shift the bit pattern five positions to the left. Similarly, because the year occupies bits 9 through 15 in the packed value, multiply the year by 29 or 512 to shift the bit pattern nine positions to the left. The bits for the day value are already in the proper positions, so no shifting is necessary. By adding the shifted values together, the packed value of the date is obtained:

```
Year    0000 1010 0000 0000
Month   0000 0001 1000 0000
Day     0000 0000 0000 0111
        ===================
Packed  0000 1011 1000 0111
value   YYYY YYYM MMMD DDDD
```

UNPACKING THE DATE

Unpacking the date back into its familiar string representation follows a similar (but reversed) process.

FIGURE 1: *Bit Pattern Shift*

ORIGINAL VALUE	DIVIDE BY	RESULT
1010 0000 = 160	2^1 = 2	0101 0000 = 80
	2^2 = 4	0010 1000 = 40
	2^3 = 8	0001 0100 = 20
	2^4 = 16	0000 1010 = 10

FIGURE 2: *Date Packed into 16-Bit Value*

```
Bits   15 14 13 12   11 10 09 08   07 06 05 04   03 02 01 00
       Y  Y  Y  Y    Y  Y  Y  M    M  M  M  D    D  D  D  D
```

YY – offset from base
MM – 1 to 12
DD – 1 to 31

FIGURE 3: *Unpacking Date from Packed Value*

```
Packed value          0000 1011 1001 0101
YEAR mask             1111 1110 0000 0000
                      ------------------
YEAR component        0000 1010 0000 0000

Packed value          0000 0111 1001 0101
MONTH mask            0000 0001 1110 0000
                      ------------------
MONTH component       0000 0001 1000 0000

Packed value          0000 0111 1000 0111
DAY mask              0000 0000 0001 1111
                      ------------------
DAY component         0000 0000 0000 0111
```

FIGURE 4: *Standard Military Time 16-Bit Map*

```
Bits   15 14 13 12   11 10 09 08   07 06 05 04   03 02 01 00
       H  H  H  H    H  M  M  M    M  M  M  X    X  X  X  X
```

HH – 0 to 23
MM – 0 to 59
XX – 0 to 30

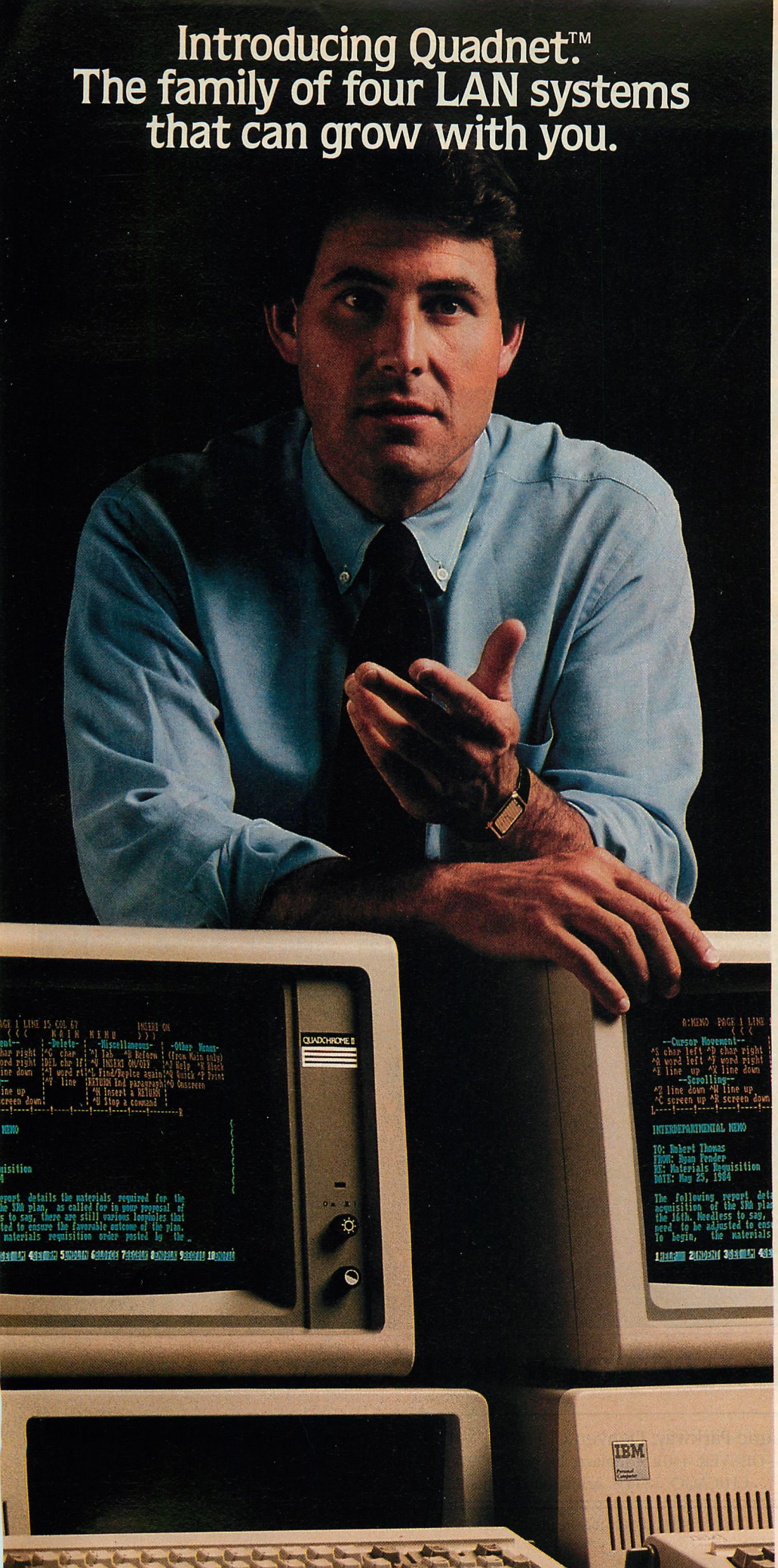
FIGURE 5: *Component Values*

HOUR
= (PACKED VALUE AND 1111 1000 0000 0000) / 2^{11}
= (21, 512 AND &HF800)/2048
= 10

MINUTE
= (PACKED VALUE AND 0000 0111 1110 0000) / 2^5
= (21, 512 AND &H07E0)/32
= 32

SECOND
= (PACKED VALUE AND 0000 0000 0001 1111) * 2
= (21, 512 AND &H001F) * 2
= 16

Introducing Quadnet.™ The family of four LAN systems that can grow with you.



The family tie.

Each member of the Quadnet family of local area network systems has its own unique characteristics. Yet all four share one family trait. The same network software.

That means you can start with the LAN system that suits your needs today. And upgrade tomorrow without having to learn a whole new set of commands. It's the only LAN system for IBM PCs, XTs and compatibles that you won't outgrow.

Making the right match.

If you're not sure which Quadnet LAN system is right for you, your Quadram dealer and our SelectNet™ software can help. This easy-to-use software will ask you a variety of questions about your planned applications, number of users, operating system, and more. Then SelectNet will recommend the ideal Quadnet match.

Quadnet comes with its own powerful multi-user operating system. Perfectly compatible with PC-DOS, Quadnet software lets you keep your current software and add on exciting multi-user packages. And while some systems limit each user to about 360K worth of data (just enough for one floppy disk), Quadnet lets you segment your hard disk any way you like.

When you're ready to order, all the accessories are pre-packaged so you're sure to get everything you need to get your Quadnet system up and running. The master package includes hardware, software and documentation. A workstation kit contains hardware for one workstation. And the cabling kit comes complete in three workstation increments.

Quadram Quality.

Insist on the Quadram name. It's your assurance that you're getting a quality product from an established and reliable company. Ask your dealer about Quadram. We don't make personal computers, we make them better.

QUADRAM QUALITY™

QUADRAM™
An Intelligent Systems Company

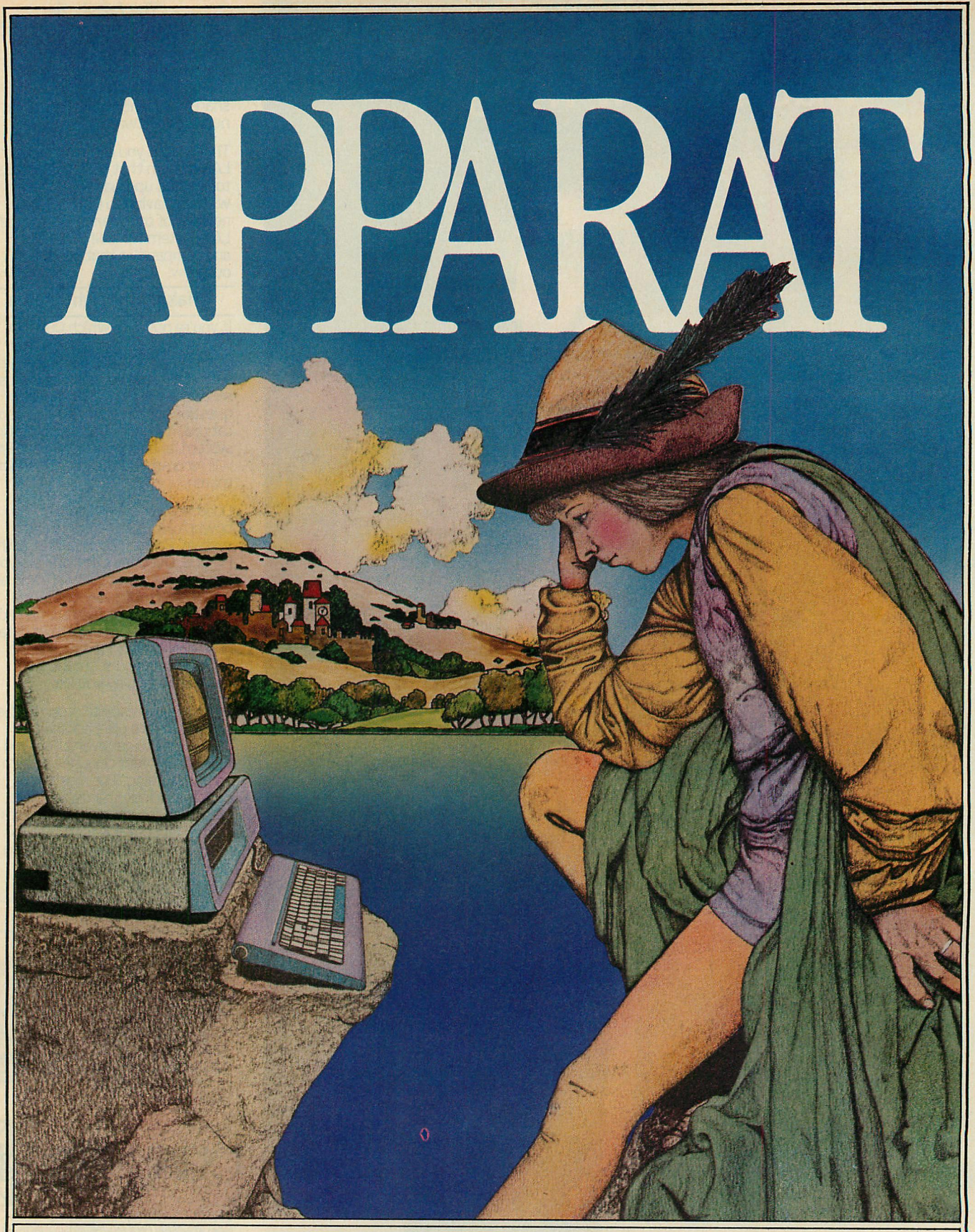
4355 International Blvd./Norcross, Ga. 30093
(404) 923-6666/TWX 810-766-4915 (QUADRAM NCRS)

INTERNATIONAL OFFICES
Interquadram Ltd. 442 Bath Road, Slough, England SL16BB
Tel: 6286-63865 Tlx: 847155 Auriema G **Interquadram GmbH**
Fasanenweg 7, 6092 Kelsterbach, West Germany Tel: 6107-3089
Tlx: 417770 Seva G **Interquadram s.a.r.l.** 41, Rue Ybry, 92522 Neuilly
Tel: 758-1240 Tlx: 630842 Iso Bur **Chevco Computing** 6581 Kitimat
Road, Mississauga, Ontario, Canada L5N-2X5 Tel: 416-821-7600

IBM® PC, XT are registered trademarks of International Business Machines Corporation.
Wordstar is a registered trademark of Micropro International Corporation.

©Copyright 1984 Quadram Corporation.
All Rights Reserved.

CIRCLE NO. 211 ON READER SERVICE CARD



APPARAT TAKES YOUR PC TO NEW REALMS.

4401 South Tamarac Parkway, Denver, CO 80237—Customer Service 303/741-1778
Apparat retail outlets—DENVER: 4401 S. Tamarac Pkwy. 303/771-2032 • 5224 W. Warren Ave. 303/985-1217
CHICAGO: 1844 S. Arlington Heights Rd. 312/640-0322

CIRCLE NO. 106 ON READER SERVICE CARD

Imagine your PC with Apparat add-ons. Imagine where it could take you.

Special values from the hard disk experts. For example, imagine your IBM PC or Portable PC with hard disk capability. Apparat's external Hard Disk Subsystem is completely compatible, running DOS 2.0 or 2.1 without modification or device drivers. And now you can get more capacity—22 and 33 MB formatted configurations—for less money. 22 MB for **$2,295,** 33 MB for **$2,995.** Apparat also offers internal or external 10 MB drives at similarly low prices.

XT owners—trade in your 10 MB drive for a larger Apparat hard disk drive. Our 22 MB drive is **$1,299,** but you pay just **$899** with a trade-in of your existing 10 MB drive. Our 33 MB drive is just **$1,799,** but you pay just **$1,399** when you trade in your existing 10 MB drive. Call the Apparat ordering hotline for trade-in details and shipping instructions.

TEAC or Panasonic floppies. These half-height floppies are perfect for your PC, PPC, or XT. Call for trade-in prices on full-height floppies.

New 28 pin EPROM programmer. Now Apparat has a new Prom Blaster for the PC, XT, PPC and PCjr to program most 28 pin EPROMS (including the 2764, 128, 256), in addition to our original Prom Blaster that programs most 24 pin EPROMS ...each **$129.** We also make an EPROM cartridge for the PCjr to accept your newly programmed EPROMS.

PPC and PCjr. Apparat has developed new products for the IBM Portable PC. Now available is a 256K RAM card and a Combo card (P & S). Both fit the PPC short slots. New for the PCjr is a 128K RAM card and a Combo jr card (P & clk). Both fit the side attachment.

Other Apparat add-ons. RAM cards for the PC and XT—64K **$189,** expandable to 512K. COMBO II card for the PC and XT, 5 functions on one card—**$189.** CRAMBO card for the PC piggybacks COMBO II on 64K RAM card—**$359.** 64K internal PRINT SPOOLER with parallel interface— **$299.** Stand-alone at **$319.**

Warranty. All Apparat manufactured P.C. boards sold after June 1, 1984 covered by our exclusive lifetime limited warranty covering parts and labor.

Apparat, Inc.

ADD ON AND ON AND ON AND ON AND ON

ORDERING AND DEALER INFORMATION

800/525-7674

Prices subject to change without notice.

DATE AND TIME

The specific bits in the packed value need to be isolated; shift the bits to the right to recover the numeric value of the month, day, and year; translate the numbers to their ASCII string representations; and rebuild the MM/DD/YY string.

To unpack the date from the newly created packed value, first, mask off only the bits needed for each component value by logically ANDing the packed value with the appropriate mask as shown in figure 3. Then shift the bits in the year component to the right nine positions by dividing by 29 or 512, and shift the month bits to the right five positions by dividing by 25 or 32. The day bits are already in the correct position. Remember that the year is an offset from the base year of 1980, so add 80 to the year component after shifting the bits. The values of the year, month, and day components after doing the division are 85, 12, and 7 respectively.

The final step is to convert these numbers to their ASCII string representations and rebuild the date string, complete with the '/' separator character. The Pascal program DATEDEMO (listing 1) demonstrates these techniques. DATEDEMO prompts for a date in MM/DD/YY format, passes it to PACK DATE, displays the resulting packed value, and then executes UNPACK DATE in order to restore the original form. (Quit the DATEDEMO program by typing END when prompted for the date.)

PACK DATE handles dates that were entered with or without leading 0s. This means that 12/7/85 and 12/07/85 will both map to the same value. UNPACK DATE does not print the leading 0 for the months January through September, but does display a leading 0 in the day field if appropriate. This simple example assumes that all values are entered within the proper range. The versions of the routines used here are much more extensive and include range edit checks.

PACKING AND UNPACKING THE TIME

Once the procedure for packing and unpacking the date is understood, then processing the time should be a snap. The standard military time representation of HH:MM:SS can be mapped into 16 bits as shown in figure 4. Note that XX represents the number of two-second intervals, since we are one bit short of being able to represent the number of seconds fully. This reduced level of resolution should not be a problem in most situations. In order to to pack the time, the hours, minutes, and seconds components must be isolated, then converted to numeric form, and the resulting values positioned in the proper places in the packed value. Assuming that each of the components has been isolated and converted to a numeric form, the packed value for the time can be generated as follows:

Packed Value =
(HOURS * 211) + (MINUTES * 25) + (SECONDS/2).

Using 10:32:16 as an example, the packed value should be 0101 0100 0000 1000 or 21,512. Work through the bit patterns to prove it to yourself.

To unpack the time, extract each component of the time using the proper bit mask and shift the resulting bit values to the right the proper number of times. Then, using the results of the previous example, calculate the component values. Figure 5 illustrates this procedure for hours, minutes, and seconds.

The seconds value need not be divided because the bits are properly aligned, but do multiply by two to convert from two-second increments into seconds. The final step would be to convert the numbers to their ASCII string representation and rebuild the familiar HH:MM:SS time string. Listing 2 is the Pascal program TIMEDEMO, which demonstrates this process.

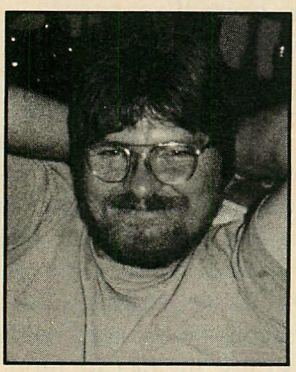
LISTING 1: DATEDEMO

```
PROGRAM DATEDEMO(INPUT,OUTPUT);

CONST
   SLASH = '/';
   BASE_YEAR = 80;

TYPE
   DATE_TYPE = STRING(8);

VAR
   REQ_DATE:DATE_TYPE;
   PACKED_VALUE:WORD;

PROCEDURE PACK_DATE(DATE_STRING:DATE_TYPE;
                    VAR DATE_WORD:WORD);

VAR
   START_POSITION:INTEGER;
   SLASH_POSITION:INTEGER;
   TEMP_WORD:WORD;
   TEMP_STRING:LSTRING(2);
   SUCCESS:BOOLEAN;

BEGIN   {PACK_DATE}

   DATE_WORD := 0;
   START_POSITION := 1;
   SLASH_POSITION := POSITN(SLASH,DATE_STRING,START_POSITION);
   MOVEL(ADR DATE_STRING[START_POSITION],ADR TEMP_STRING[1],
         WRD(SLASH_POSITION - START_POSITION));
   TEMP_STRING.LEN := LOBYTE(SLASH_POSITION - START_POSITION);
   SUCCESS := DECODE(TEMP_STRING,TEMP_WORD);
   DATE_WORD := DATE_WORD + (TEMP_WORD * 32);

   START_POSITION := SLASH_POSITION + 1;
   TEMP_WORD := 0;
   SLASH_POSITION := POSITN(SLASH,DATE_STRING,START_POSITION);
   MOVEL(ADR DATE_STRING[START_POSITION],ADR TEMP_STRING[1],
         WRD(SLASH_POSITION - START_POSITION));
   TEMP_STRING.LEN := LOBYTE(SLASH_POSITION - START_POSITION);
   SUCCESS := DECODE(TEMP_STRING,TEMP_WORD);
   DATE_WORD := DATE_WORD + TEMP_WORD;

   START_POSITION := SLASH_POSITION + 1;
   TEMP_WORD := 0;
   MOVEL(ADR DATE_STRING[START_POSITION],ADR TEMP_STRING[1],2);
   TEMP_STRING.LEN := 2;
   SUCCESS := DECODE(TEMP_STRING,TEMP_WORD);
   IF TEMP_WORD < BASE_YEAR THEN
      DATE_WORD := DATE_WORD + (((100 - BASE_YEAR) + TEMP_WORD) * 512)

      ELSE
         DATE_WORD := DATE_WORD + ((TEMP_WORD - BASE_YEAR) * 512);

END;   {PACK_DATE}


PROCEDURE UNPACK_DATE(VAR DATE_STRING:DATE_TYPE;
                      DATE_WORD:WORD);

VAR
   TEMP_WORD:WORD;
   TEMP_STRING:LSTRING(2);
   SUCCESS:BOOLEAN;

BEGIN   {UNPACK_DATE}

   DATE_STRING := '        ';

   TEMP_WORD := (DATE_WORD AND 16#01E0) DIV 32;
   SUCCESS := ENCODE(TEMP_STRING,TEMP_WORD:2);
   MOVEL(ADR TEMP_STRING[1],ADR DATE_STRING[1],2);
   DATE_STRING[3] := SLASH;

   TEMP_WORD := (DATE_WORD AND 16#001F);
   SUCCESS := ENCODE(TEMP_STRING,TEMP_WORD:2);
```


Rollinsoft PCsoftware Don Buresh Ron Watson

PC FIRING LINE / PC UNDERGROUND™

Technical Disk Magazine

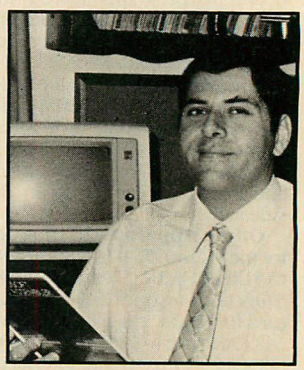


Dan Rollins

Throw away your paper magazines! Save shelf space, save programming time, with the sizzling ready-to-use source code provided in each powerful bimonthly issue (currently 2 DS/DD disks per issue).

Dan Rollins, captured here relaxing after installing a device driver, has provided PCFL/PCUG with Polymaze, a maze generation program designed to delight children of all ages.

As editor of PC FIRING LINE/PC UNDERGROUND (alias Bill Salkin), I defy you to find the following topics discussed in any magazine—be it paper or disk: hardware maintenance, installing device drivers, critical-error handling, the EXEC function call, random file I/O, different memory models, bicubic splines, "printf" source code, and reducing the flab from IBM Pascal routines. High-sailing columns on Ada, Assembly, BASIC, C, FORTH, FORTRAN, LISP, Pascal, Hardware, and DOS! And NO paper magazine can supply FREEWARE, programmer-oriented DEMOS, and utilities in a ready-to-run format.



Bill Salkin

If you have been turned off by disk magazines, then look again. PCFL/PCUG—the magazine of the future—is available today for $12 per single issue (half the price of our competitors' and we contain at least twice their content) or $72 for a one-year (six-issue) subscription.

All funds in U.S. dollars. Foreign countries please send money orders and add $5 (U.S.) airmail for each issue.

Requires an IBM-PC, 128K RAM, and a double-sided disk drive. We ship ONLY DS/DD disks.

ABComputing

P.O. Box 5503, North Hollywood, CA 91616-5503 • (818) 509-9002

Guy M. Kelly Gary M. Rader Ken Holcombe Microcompatibles

CIRCLE NO. 101 ON READER SERVICE CARD

```
   IF TEMP_STRING[1] = ' ' THEN TEMP_STRING[1] := '0';
   MOVEL(ADR TEMP_STRING[1],ADR DATE_STRING[4],2);
   DATE_STRING[6] := SLASH;

   TEMP_WORD := ((DATE_WORD AND 16#FE00) DIV 512);
   IF TEMP_WORD < (100 - BASE_YEAR)
      THEN TEMP_WORD := TEMP_WORD + BASE_YEAR
      ELSE TEMP_WORD := TEMP_WORD + BASE_YEAR - 100;
   SUCCESS := ENCODE(TEMP_STRING,TEMP_WORD:2);
   IF TEMP_STRING[1] = ' ' THEN TEMP_STRING[1] := '0';
   MOVEL(ADR TEMP_STRING[1],ADR DATE_STRING[7],2);

END;   {UNPACK_DATE}


BEGIN   {DATEDEMO}

   REPEAT
      PACKED_VALUE := 0;
      WRITE(OUTPUT,'Enter the date [MM/DD/YY]: ');
      READLN(INPUT,REQ_DATE);
      IF REQ_DATE = 'END     ' THEN CYCLE;

      PACK_DATE(REQ_DATE,PACKED_VALUE);
      WRITELN(OUTPUT,' ');
      WRITELN(OUTPUT,'   The packed value for ',REQ_DATE,' IS ',
              PACKED_VALUE);
      WRITELN(OUTPUT,' ');
      REQ_DATE := '        ';
      UNPACK_DATE(REQ_DATE,PACKED_VALUE);
      WRITELN(OUTPUT,'   The unpacked string for ',PACKED_VALUE,
              ' IS ',REQ_DATE);
      WRITELN(OUTPUT,' ');
      WRITELN(OUTPUT,'-------------------------');
   UNTIL REQ_DATE = 'END     ';

   WRITELN(OUTPUT,' ');
   WRITELN(OUTPUT,'End of DATEDEMO program');
END.   {DATEDEMO}
```

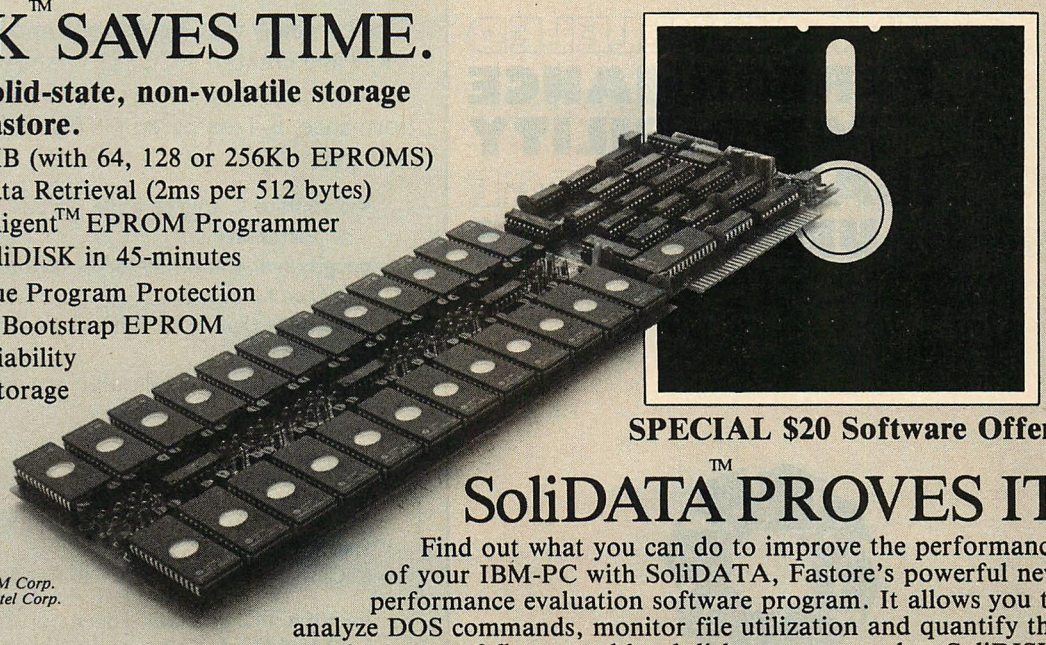
LISTING 2: TIMEDEMO

```
PROGRAM TIMEDEMO(INPUT,OUTPUT);

CONST
   COLON = ':';

TYPE
   TIME_TYPE = STRING(8);

VAR
   REQ_TIME:TIME_TYPE;
   PACKED_VALUE:WORD;

PROCEDURE PACK_TIME(TIME_STRING:TIME_TYPE;
                    VAR TIME_WORD:WORD);

VAR
   START_POSITION:INTEGER;
   COLON_POSITION:INTEGER;
   TEMP_WORD:WORD;
   TEMP_STRING:LSTRING(2);
   SUCCESS:BOOLEAN;

BEGIN   {PACK_TIME}

   TIME_WORD := 0;
   START_POSITION := 1;
   COLON_POSITION := POSITN(COLON,TIME_STRING,START_POSITION);
   MOVEL(ADR TIME_STRING[START_POSITION],ADR TEMP_STRING[1],
         WRD(COLON_POSITION - START_POSITION));
   TEMP_STRING.LEN := LOBYTE(COLON_POSITION - START_POSITION);
   SUCCESS := DECODE(TEMP_STRING,TEMP_WORD);
   TIME_WORD := TIME_WORD + (TEMP_WORD * 2048);

   START_POSITION := COLON_POSITION + 1;
   TEMP_WORD := 0;
   COLON_POSITION := POSITN(COLON,TIME_STRING,START_POSITION);
```


SoliDISK™ SAVES TIME.

SoliDISK...a solid-state, non-volatile storage system from Fastore.

- ☐ 192KB to 768KB (with 64, 128 or 256Kb EPROMS)
- ☐ High Speed Data Retrieval (2ms per 512 bytes)
- ☐ On-Board Inteligent™ EPROM Programmer
  - Programs SoliDISK in 45-minutes
- ☐ Provides Unique Program Protection
- ☐ Optional Auto Bootstrap EPROM
- ☐ Solid-State Reliability
- ☐ Non-Volatile Storage
- ☐ Low power



IBM PC is a trademark of IBM Corp.
Inteligent is a trademark of Intel Corp.
Dealer inquiries invited.

Single-Density (192KB)	$ 650
Double-Density (384KB)	$1,250
Quad-Density (768KB)	$2,500
Auto-Boot option	$ 75
SoliDISK Eraser	$ 95

*** Send check or money order to Fastore.**
Postage/Handling included.
Send business card or call for free information.

SPECIAL $20 Software Offer

SoliDATA™ PROVES IT.

Find out what you can do to improve the performance of your IBM-PC with SoliDATA, Fastore's powerful new performance evaluation software program. It allows you to analyze DOS commands, monitor file utilization and quantify the performance of floppy and hard disks as compared to SoliDISK.

A $79.00 Value, SoliDATA Performance Evaluation Software is available for a limited time for only $20.00.* Money back if not fully satisfied.

FASTORE

200 Danbury Road • Wilton, CT 06897 • 203-834-1975

CIRCLE NO. 130 ON READER SERVICE CARD

```
    MOVEL(ADR TIME_STRING[START_POSITION],ADR TEMP_STRING[1],
          WRD(COLON_POSITION - START_POSITION));
    TEMP_STRING.LEN := LOBYTE(COLON_POSITION - START_POSITION);
    SUCCESS := DECODE(TEMP_STRING,TEMP_WORD);
    TIME_WORD := TIME_WORD + (TEMP_WORD * 32);

    START_POSITION := COLON_POSITION + 1;
    TEMP_WORD := 0;
    MOVEL(ADR TIME_STRING[START_POSITION],ADR TEMP_STRING[1],2);
    TEMP_STRING.LEN := 2;
    SUCCESS := DECODE(TEMP_STRING,TEMP_WORD);
    TIME_WORD := TIME_WORD + (TEMP_WORD/WRD(2));

END;   {PACK_TIME}
PROCEDURE UNPACK_TIME(VAR TIME_STRING:TIME_TYPE;
                      TIME_WORD:WORD);

VAR
    TEMP_WORD:WORD;
    TEMP_STRING:LSTRING(2);
    SUCCESS:BOOLEAN;

BEGIN   {UNPACK_TIME}

    TIME_STRING := '        ';

    TEMP_WORD := (TIME_WORD AND 16#F800) DIV 2048;
    SUCCESS := ENCODE(TEMP_STRING,TEMP_WORD:2);
    MOVEL(ADR TEMP_STRING[1],ADR TIME_STRING[1],2);
    TIME_STRING[3] := COLON;

    TEMP_WORD := (TIME_WORD AND 16#07E0) DIV 32;
    SUCCESS := ENCODE(TEMP_STRING,TEMP_WORD:2);
    IF TEMP_STRING[1] = ' ' THEN TEMP_STRING[1] := '0';
    MOVEL(ADR TEMP_STRING[1],ADR TIME_STRING[4],2);
    TIME_STRING[6] := COLON;

    TEMP_WORD := (TIME_WORD AND 16#001F) * 2;
    SUCCESS := ENCODE(TEMP_STRING,TEMP_WORD:2);
    IF TEMP_STRING[1] = ' ' THEN TEMP_STRING[1] := '0';
    MOVEL(ADR TEMP_STRING[1],ADR TIME_STRING[7],2);

END;   {UNPACK_TIME}


BEGIN   {TIMEDEMO}

    REPEAT
       PACKED_VALUE := 0;
       WRITE(OUTPUT,'Enter the time [HH:MM:SS]: ');
       READLN(INPUT,REQ_TIME);
       IF REQ_TIME = 'END     ' THEN CYCLE;

       PACK_TIME(REQ_TIME,PACKED_VALUE);
       WRITELN(OUTPUT,' ');
       WRITELN(OUTPUT,'   The packed value for ',REQ_TIME,
              ' IS ',PACKED_VALUE);
       WRITELN(OUTPUT,' ');
       REQ_TIME := '        ';
       UNPACK_TIME(REQ_TIME,PACKED_VALUE);
       WRITELN(OUTPUT,'   The unpacked string for ',PACKED_VALUE,
              ' IS ',REQ_TIME);
       WRITELN(OUTPUT,' ');
       WRITELN(OUTPUT,'-------------------------');
    UNTIL REQ_TIME = 'END     ';

    WRITELN(OUTPUT,' ');
    WRITELN(OUTPUT,'End of TIMEDEMO program');
END.   {TIMEDEMO}
```


UNPARALLELED
PERFORMANCE
and **PORTABILITY**
in an **ISAM** PACKAGE
at an **UNBEATABLE**
PRICE

c-tree™
BY FAIRCOM

2606 Johnson Drive
Columbia MO 65203

The company that introduced micros to B-Trees in 1979 and created ACCESS MANAGER™ for Digital Research, now redefines the market for high performance, B-Tree based file handlers. With c-tree™ you get:

- complete C source code written to K & R standards of portability
- high level, multi-key ISAM routines and low level B-Tree functions
- routines that work with single-user and network systems
- no royalties on application programs

$395 COMPLETE

Specify format:
8" CP/M® 5¼" PC-DOS 8" RT-11

for VISA, MC or COD orders, call
1-314-445-6833

Access Manager and CP/M are trademarks of Digital Research, Inc.
c-tree and the circular disc logo are trademarks of FairCom

© 1984 FairCom

CIRCLE NO. 119 ON READER SERVICE CARD

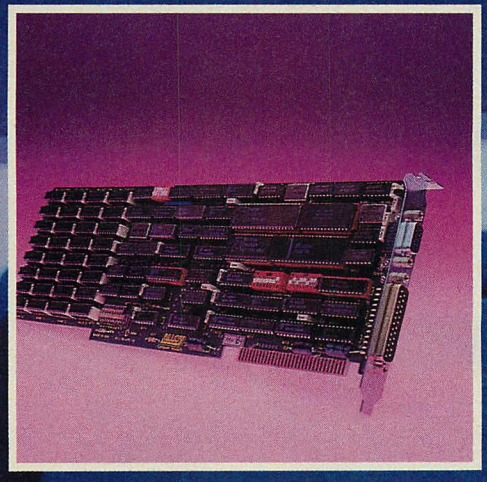
Alloy makes your PC multi-user.

Introducing Alloy's PC-SLAVE/16. The multi-user PC strategy that doesn't require additional PCs.

PC-SLAVE/16 transforms your IBM PC into a multi-user, multi-processor system with shared data access and communication between users. All you need is a dumb terminal and a PC-SLAVE/16 board for each user.

And with Alloy's PC-X BUS, you can add up to 31 users. So whether you're adding your secretary or 31 colleagues, Alloy's PC-SLAVE/16 can do it at a much lower cost and with higher performance.

For any system requiring more than one PC, PC-SLAVE/16 is more powerful and less expensive. Each board comes complete with its own 8 MHz, 8088 micro processor and dedicated memory. PC-SLAVE/16 eliminates the need to add costly PCs. And it is ten times faster than LANs (Local Area Networks) at half the cost. Best of all, it's available right now. See PC-SLAVE/16 in action at your local dealer. Or call Alloy today at (617) 875-6100.



ALLOY
Computer Products, Inc.

Alloy Computer Products, Inc., 100 Pennsylvania Avenue, Framingham, Massachusetts 01701. (617) 875-6100, TWX: 710-346-0394
In Europe: Alloy Computer Products (Europe) Ltd., Cirencester, Gloucestershire, England. Tel: 0285-68709, Tlx: 43340

CIRCLE NO. 111 ON READER SERVICE CARD

THE LIGHTS WILL COME BACK ON. YOUR DATA MAY NOT.

When the power goes down, so does your computer—maybe taking your data with it.

If you had last year's sales figures with next year's projections on screen, you're going to be in the dark a long time. Maybe too long.

Unless you backup your data.

Every day.

No matter what.

The smartest way to do that is with a Tallgrass HardFile™ Mass Storage System.

Shown above, the 20 megabyte HardFile with 20 megabyte tape for $2,995.

TALLGRASS SELLS MORE HARD DISK STORAGE WITH CARTRIDGE TAPE BACKUP THAN ANYONE IN THE WORLD.

Tallgrass took the industry's most reliable medium—magnetic tape—and perfected a format that's become the standard for personal computers.

We used a removable tape cartridge to store data out of

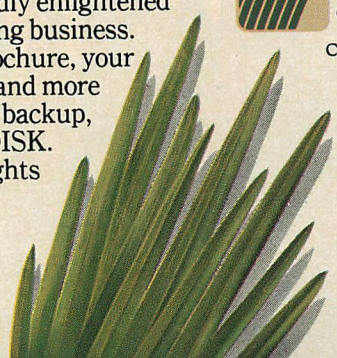
harm's way. And made two versions. Our 3000 Series HardFiles combine tape's accuracy with the enormous capacities of hard disk, with 12, 20, 35 or 70 megabytes storage with a removable cartridge tape for backup. Our 4060 tape storage system, for personal computers with hard disks built in, supplies 60 megabytes of backup capacity.

Result: the world's best selling mass storage systems with the most reliable data protection.

And a decidedly enlightened approach to doing business.

For a free brochure, your nearest dealer, and more good reasons to backup, call 1-800-228-DISK.

Before the lights go out.



TALLGRASS® TECHNOLOGIES

COMMITTED TO MEMORY

CIRCLE NO. 234 ON READER SERVICE CARD

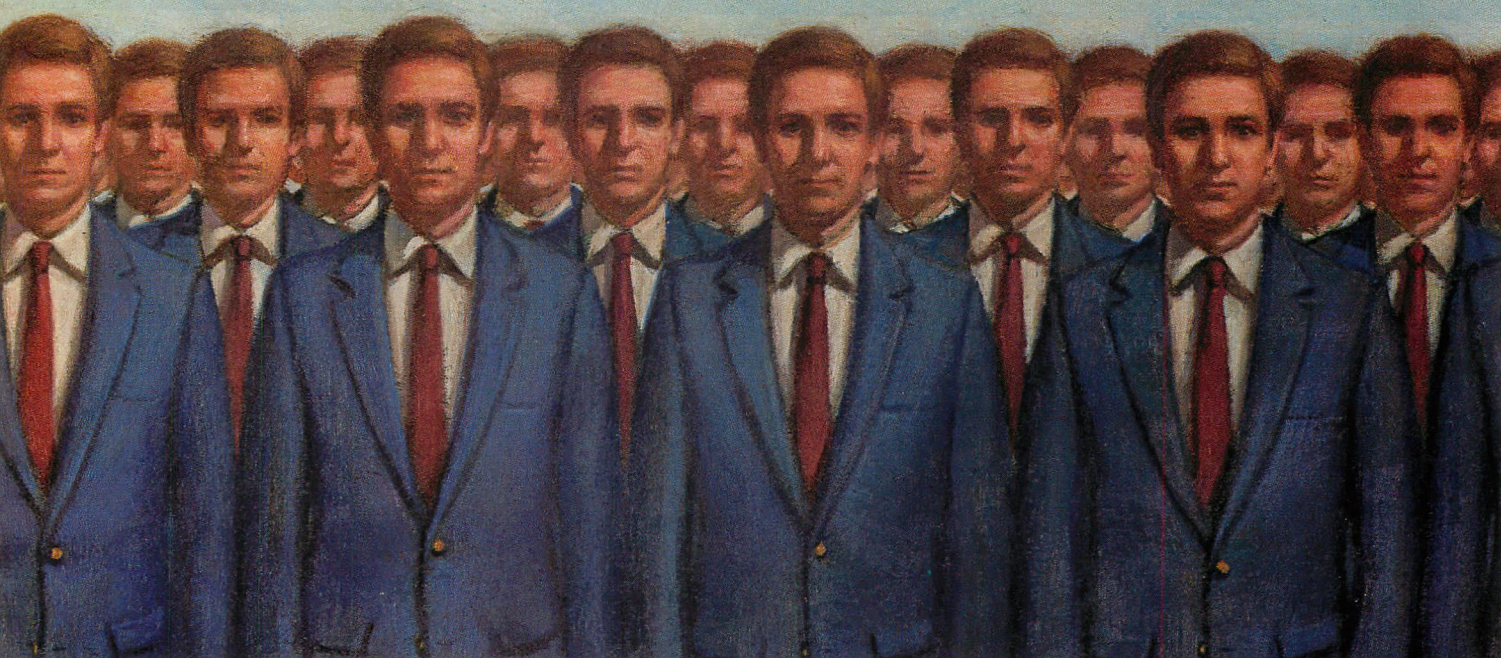
HardFile™ and Tallgrass® are trademarks of Tallgrass Technologies Corporation. © 1984 Tallgrass Technologies.

The Maverick Controller

The nonconformist SMD PC-80 offers greater storage versatility than do other fixed-disk controllers for the PC.

The Maverick SMD PC-80 hard-disk controller has been aptly named. It is the first product of its kind to offer PC users connectivity with high-capacity storage modules that are not normally available on desktop computers. By using the industry-standard SMD (storage module drive) interface, the Maverick controller, made by Interphase Corporation of Dallas, Texas, brings a new level of performance and disk storage capacity to the PC.

JULIE ANDERSON



CONTROLLER BOARD SPECS

The Maverick PC-80 occupies a single slot in a PC or PC/XT, and it can manage up to two SMD-compatible drives (fixed or removable) with storage capacities ranging from 16MB to 1.6 gigabytes. The controller was designed using CMOS technology for low power consumption and is capable of high-speed DMA with data transfer rates of 2.5 MB/sec. The Maverick controller is also able to perform overlapped seeks, bad track remapping, and it supports variable sector interleaving. A 32-bit error checking and correction (ECC) code allows 11-bit error correction, thus giving the same level of error detection as that provided by the PC's fixed-disk drive adapter. The controller will operate under DOS 2.0 and 2.1, as well as the QNX and COHERENT operating systems. And, as might be expected, DOS 3.0 support is coming soon.

THE SMD INTERFACE

The storage module drive, or SMD, interface specifies an electrical connection between a controller and disk drives. Developed by Control Data Corporation, SMD has been widely accepted and is followed by more than 14 disk manufacturers, including Fujitsu, Kennedy, NEC, and Priam. Control Data itself offers at least nine disk models adhering to the SMD interface. Typically, SMD-compatible drives have storage capacities that far exceed those that are normally provided on a microcomputer—in many cases, they are hundreds of megabytes.

The SMD interface consists of digital signals transmitted over two cables: the A cable is a 60-pin, twisted-pair, flat cable, with a maximum cumulative length of 100 feet, on which control and data signals are transmitted; the B cable is a 26-pin, ribbon-flat cable with ground plane and drain wire, with a maximum length of 50 feet, on which read and write information is transmitted. Figure 1 shows the pin as-

FIGURE 1: *SMD Interface A Cable Pin Assignments*

BALANCED SIGNAL PINS (LOW, HIGH)	SIGNAL NAME	SIGNAL DIRECTION CONTROLLER DRIVE
1,31	Tag 1, Cylinder Select	→
2,32	Tag 2, Head Select	→
3,33	Tag 3, Control Select	→
4,34	Bus Lines Bit 0	→
5,35	Bit 1	→
6,36	Bit 2	→
7,37	Bit 3	→
8,38	Bit 4	→
9,39	Bit 5	→
10,40	Bit 6	→
11,41	Bit 7	→
12,42	Bit 8	→
13,43	Bit 9	→
14,44	Open Cable Detector	→
15,45	Fault	←
16,46	Seek Error	←
17,47	On Cylinder	←
18,48	Index	←
19,49	Unit Ready	←
20,50	Address Mark Found	←
21,51	Busy	←
22,52	Unit Select Tag	→
23,53	Unit Select 2^0	→
24,54	Unit Select 2^1	→
25,55	Sector	←
26,56	Unit Select 2^2	→
27,57	Unit Select 2^3	→
28,58	Write Protected	←
29	Power Sequence Pick	→
59	Power Sequence Hold	→
30,60	Spare (Not Used)	

FIGURE 2: *SMD Interface B Cable Pin Assignments*

BALANCED SIGNAL PINS (LOW, HIGH)	SIGNAL NAME	SIGNAL DIRECTION CONTROLLER DRIVE
1	Ground	
2,14	Servo Clock	←
15	Ground	
3,16	Read Data	←
4	Ground	
5,17	Read Clock	←
18	Ground	
8,20	Write Data	→
7	Ground	
6,19	Write Clock	→
21	Ground	
22,9	Unit Selected	←
10,23	Seek End	←
11	Ground	
12,24	Index	←
25	Ground	
13,26	Sector	←

signments for the A cable and figure 2 shows them for the B cable.

The 10 bus lines on the A cable transmit different information depending on the value of the tag bits. If Tag 1 is set, then all 10 bus lines combine to select the cylinder address. When Tag 2 is set, bus lines 0 through 4 are used to select the read/write head. This yields a theoretical maximum of 2^{10}, or 512, tracks and 2^5, or 32, heads that can be addressed through the SMD interface. It is natural to assume that the SMD interface specifications allow such large-capacity disk drives to be attached to the IBM PC. In fact, a surprising revelation is that the PC fixed-disk adapter also allows 10 bits for a cylinder address and it allows 5 bits for a read/write head address.

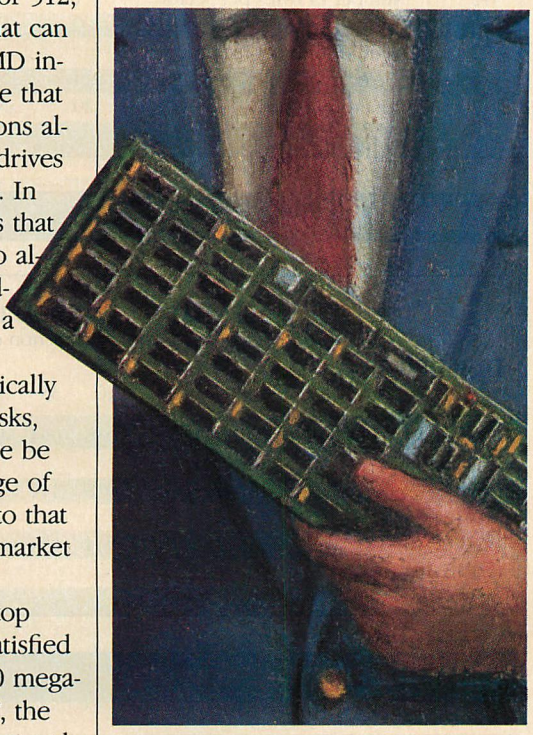
If both interfaces are logically equipped to address large disks, why should the SMD interface be the only way to take advantage of such capacities? The answer to that question has to do with the market demand for mass storage.

Traditionally, small desktop computer users have been satisfied with capacities of 5, 10, or 20 megabytes. Even on IBM's new AT, the maximum storage capacity currently supported is 40MB. By most minicomputer or mainframe standards, this is piddling. Disk-drive manufacturers have responded with devices to meet this demand, and the most popular capacity today is just 10 MB.

On the open market, however, manufacturers have built 8- and 14-inch drives with capacities of 500MB or more and excellent price/capacity ratios. Just about all of these drives use the SMD interface. For those users with capacity requirements far in excess of the usual drives (for example, data management, laboratory, or network service), it would seem that SMD drives offer the ideal solution. Interphase has chosen to provide the PC owner with a means to tap this valuable resource.

INSTALLATION

Installation consists of three steps: inserting the controller into the PC and attaching the cables to the disk drives, configuring a device driver, and initializing the disks. Easy-to-use, interactive utilities are provided to configure the device driver and to initialize the disk. The nontechnical *Installation and User's*



Manual guides the user effortlessly through the installation process.

As shipped from the factory, the controller board is correctly configured for the IBM PC (DIP switches 4,7,8 on; all others off). This sets the I/O base address to 360H, and the boot ROM address to D8000H. Interrupt request 5 is used to indicate command completion, and DMA request channel 3 is used as well as DMA acknowledge channel 3. The controller needs only to be inserted into a full-size empty slot in the PC. The SMD A cable is attached first to the controller board, then to drive 0. If a second drive is present, then the A cable is daisy-chained from the first drive to the second. Separate B cables are attached to each drive from the board. The drives should be configured for 512-byte sectors and set for the appropriate unit (0 or 1). If hard sectoring is supported by the drive, it should also be selected. For this review, the Maverick SMD PC-80 controller was installed under DOS 2.1 in a PC with two DSDD diskette drives, no expansion chassis, 512KB of memory, an AST Mega-Plus-2 multifunction board, a monochrome adapter and display, and a color graphics adapter and display. *PC Tech Journal* tested the controller using an Amcodyne Arapahoe 7110 SMD 50MB disk drive, provided by Interphase, which has a 25MB removable cartridge disk and a 25MB fixed disk.

DEVICE DRIVER CONFIGURATION

The next step is to custom-configure a DOS device driver. This is done with the program SMDCFIG, which takes as its input a configuration file that describes the drive's parameters. Interphase supplies configuration files for more than 20 different disk drives, but any SMD drive can be used if a configuration file is created for it. A sample configuration file, GENERIC.CFG, that is supplied on the installation disk can be edited for the customer's particular SMD drive. Interphase will provide technical support to any customer needing help creating the configuration file. Figure 3 shows the configuration file used for the Amcodyne Arapahoe drive.

In addition to describing the physical characteristics of the drive, such as the number of cylinders, heads, and sectors per track, and the sector interleave factor, the configuration file also contains information that is used for dividing the physical units into logical units. A maximum of 24 logical units can be defined, each of them holding as many as 32MB. DOS recognizes each logical unit as a block device—that is, as device C:, D:, etc. Sectors 0 and 1 on each physical

unit are reserved for a boot sector and controller information.

VOLUME INITIALIZATION

The utility, SMDINIT, formats the logical volumes. It writes the header information for each sector and a dummy data field, writes the volume label, and creates the DOS root directory and file allocation table. When the logical volume is defined, a number of cylinders can be designated as reserved. These are used for remapping bad tracks. The bad tracks can be included in a defects text file, and they will be remapped by the SMDINIT utility. SMDINIT creates a hidden file, DEFECTS$.SYS, in the root directory, which contains the remapping information. This file is used by SMDFMT to reformat the disk. Actual remapping is invisible to the operating system. The header information on the bad track contains the address of the substitute track.

For the Amcodyne drive, the Interphase-supplied configuration file specified 20 reserved cylinders in each logical volume; that translates into 640KB per volume (20 cylinders * 2 heads * 32 sectors/track * 512 bytes/sector). Interphase recommends 20 reserved cylinders to allow a comfortable margin for bad track remapping. However, when the SMDINIT utility was run on the Amcodyne drive, only one bad track was found in each volume, so 20 reserved cylinders seemed to be overkill. In fact, no cylinders need to be reserved at all. If bad tracks are found when there are no more reserved cylinders, SMDINIT will mark the bad area as allocated in the DOS file allocation table. Note that this is an effective means of remapping tracks only if all disk accesses go through the DOS file management system.

HARDWARE COMPATIBILITY

Interphase has designed the Maverick controller board to be versatile and capable of being configured to work with other hardware a user has installed. The company's aim is to free the user from having to go through an extensive configuration process or to alter existing equipment. In a PC/XT, the Maverick controller shares the DMA channel and IRQ with the fixed disk. If the user wants to use the controller in or with an expansion chassis, the controller board can be custom-configured at the factory.

FIGURE 3: *Amcodyne Configuration File*

AMCODYNE 7110 (ARAPAHOE)

644	;Total number of cylinders	14	;Spiral skew offset
2	;Number of volumes	5	;Attribute flags
0	;Starting head for volume 0	1	;Number of logical units on volume 0
2	;Number of heads for volume 0	1	;Fixed/removable for volume 0
2	;Starting head for volume 1		(0 if fixed, 1 if removable)
2	;Number of heads for volume 1	624	;Number of data cylinders (LUN 0)
32	;Number of sectors per track	20	;Number of reserved cylinders (LUN 0)
512	;Number of bytes per sector	1	;Number of logical units on volume 1
28	;Number of bytes in gap 1	0	;Fixed/removable for volume 1
22	;Number of bytes in gap 2		(0 if fixed, 1 if removable)
4	;Sector interleave factor	624	;Number of data cylinders (LUN 0)
3	;Data retry count	20	;Number of reserved cylinders (LUN 0)

TABLE 1: *Fixed-disk Benchmarks*

DISK DRIVE	SEQUENTIAL (Number of Sectors)				RANDOM 1-SECTOR (Fraction of Disk)				RANDOM 8-SECTOR (Fraction of Disk)			
	1	8	16	24	.10	.33	.50	.90	.10	.33	.50	.90
Maverick (50MB)	.019	.036	.055	.082	.036	.054	.054	.069	.058	.071	.071	.088
PC/XT (10MB)	.022	.071	.129	.187	.078	.111	.146	.221	.124	.165	.190	.275
PC/AT (20MB)	.003	.027	.052	.077	.044	.044	.054	.069	.063	.069	.074	.091

TABLE 2: *Disk Drive Specs*

	AMCODYNE (50MB)	PC/XT (10MB)	PC/AT (20MB)
Access time track to track	10 ms	3 ms	2 ms
Average latency	8.5 ms	8.33 ms	8.4 ms
Rotation speed	3545 rpm	3600 rpm	3573 rpm
Data transfer rate	1.2MB/sec	625KB/sec	625KB/sec
Track density	555 tpi	345 tpi	750 tpi

DOS COMPATIBILITY

Interphase claims that any program that goes through DOS or uses BIOS calls will work with the controller. It is recommended that the number of DOS buffers be set to 10 by using the BUFFERS= command in the CONFIG.SYS file. The device driver created by the SMDCFIG utility is installed by including the DEVICE= command in the CONFIG.SYS file. This means that a dis-

kette must be used to boot the system. Interphase is working on a version of the controller that allows booting from the hard disk. When the new version of the controller is released, a utility, UPGRADE, will be provided that reconfigures the disk device driver and writes the boot sector to the hard disk.

One problem with DOS versions 2.0 and 2.1 is that only a 12-bit FAT can be used, allowing a maximum of 4,079 clusters per logical unit. On the Amcodyne drive, which has a formatted capacity of 21MB on each of the removable and fixed volumes, the cluster size has to be a whopping 16 sectors in order to reduce the total number of clusters below the maximum. (DOS requires the cluster size to be a power of 2). This means that files are allocated in increments of 16 sectors, or 8,192 bytes, an inefficient allocation unit for small files. I moved my collection of files from a 10MB disk to the Amcodyne removable cartridge. The same files that used 6.6MB on the XT disk required 8MB on the Amcodyne drive. The XT fixed disk uses a cluster size of eight sectors, and even this cluster size is wasteful. At the time this article was written, Interphase was beta testing its DOS 3.0 version. DOS 3.0 supports use of a 16-bit FAT, which allows a smaller cluster size and, therefore, it allows for a more efficient use of the higher capacity disks.

The DOS command FORMAT cannot be used with the Maverick controller—DOS complains that the disk is not compatible, but the Interphase-supplied utility, SMDFMT, can reformat a logical unit, display remapped tracks, and allow manual remapping of bad tracks. Also, the DOS utility FDISK does not recognize the controller, and, at the moment, no other way exists to create and manage partitions.

The DOS commands BACKUP and RESTORE do work with the controller. This may seem little consolation after calculating the number of 360KB diskettes it would take to back up even 21MB. However, it is possible to use BACKUP and RESTORE between the fixed and removable volumes of the Amcodyne disk—a workable situation. Another utility planned but not yet provided, SMDCOPY, will perform an image copy from the fixed to the removable disk. Interphase claims that this program will back up 25MB of data in less than five minutes.

The Maverick controller returned a performance comparable to a PC/AT 20MB disk and controller, even though the AT uses a 16-bit external data path.

PERFORMANCE

The standard fixed-disk benchmarks as developed by William Hunt and described in "Fixed-disk Benchmarks" (*PC Tech Journal*, November 1984, p. 64) were run on the Maverick controller. The results of the tests were pleasing. As shown in table 1, the Maverick controller with the Amcodyne drive attached ran two to three times faster than an XT 10MB disk and controller. The greatest improvement in performance was noticeable during longer seeks and multiple sectors transfers. This is due in part to the Amcodyne drive's high-speed data transfer rate (1.2MB/sec), which is 2.5 times the transfer rate of the XT's disk drive. However, note that the Maverick controller is capable of delivering a data-transfer rate of 2.5MB/sec, which is twice that of the Amcodyne drive.

The interleave factor of the drive also has a bearing on the effective data transfer rate; the faster the controller can access the next logical sector, the lower the interleave factor can be. Again the Amcodyne drive has an advantage; its interleave factor is 4 while the XT's interleave factor is 6.

The Maverick SMD controller returned a performance that was comparable to a PC/AT 20MB disk and controller. This is especially significant since the AT uses a 16-bit external data path as compared to the 8-bit external data path of the PC. However, since the data transfer rate of the Amcodyne drive is two times that of the AT drive, equivalent throughput is thus realized. The specifications for each disk drive are shown in table 2.

RECOMMENDATION

The Interphase Maverick PC-80 is easy to install, compatible with existing equipment, and out-performs the smaller XT disks. It is also the only controller I know of that offers IBM PC users the power and enormous capacity of SMD-compatible drives. Interphase has been slow to offer the necessary utilities to provide a workable environment, but once the promised enhancements, such as booting from the fixed disk, DOS 3.0 support, a high-speed back-up utility, and a partition management program are provided, the Maverick controller can be highly recommended as a fully functional alternative for those who need greater storage capacity and faster performance than the typical 5¼-inch disk controllers can deliver.

Maverick SMD PC-80 Hard-disk Controller
Interphase Corporation
2925 Merrell Road
Dallas, TX 75229
214/350-9000
$1,295 (Controller and Utilities)
CIRCLE 481 ON READER SERVICE CARD


dBASE II!
SOUNDHEAD MOTOR
FORWARD
REVERSE
ON
OFF

Take III

Converting dBASE II applications to dBASE III requires new approaches to old difficulties.

CHRIS CHRISTIAN

People who have created applications systems using Ashton-Tate's dBASE II database-management program and who contemplate converting such applications for use with the newer version, dBASE III, will discover that solutions to applications problems take subtly different forms in dBASE III than in dBASE II.

Beyond its altered syntax and new commands, dBASE III has other characteristics distinguishing it from dBASE II; these differences require programmers to take a new approach when applying dBASE III to information problems. Some of these differences solve old difficulties. Others create new ones. Awareness of the pros and cons will help users choose between dBASE II and dBASE III for future applications.

dBASE III is considered here only as a programming language, not as an interactive database manager (nonprogrammed mode). Many of dBASE III's new features, including the extensive ASSIST and HELP facilities and the REPORT and LABEL makers, have been specifically designed to make the program easier to use by the nonprogrammer. Details of these features are mentioned here only in terms of the suitable translation of dBASE II functionality to dBASE III code.

All things considered, dBASE III is not a "problem-fix" release, but an entirely new program, written in

Chris Christian is a software author and consultant in dBASE applications. He last reviewed Autocode 1 for PC Tech Journal.

C for portability, and designed for the address space and DOS functions found in the 16-bit environment. The changes involved a complete redesign, unlike the changes from version 2.3B to 2.4 of dBASE II; therefore, the new version was not called dBASE II version 2.5.

DIFFERENT CAPACITY, FUNCTIONS, AND APPEARANCE

There are cosmetic, user interface, and conceptual differences between dBASE II and dBASE III. Table 1 shows the raw capacity changes between the two. dBASE III is a heftier product. It accommodates more fields per record, longer records, and more records per database. It allows ten databases to be used at once instead of merely two. There is a fourfold increase in the number of memory variables and space for memory variables, and numeric precision is increased. Note also the larger screen size and the presence of a type-ahead buffer.

Functional differences between dBASE II and dBASE III are shown in table 2. dBASE III adds some new, built-in functions, which are shown in table 3. Some of these functional differences can be characterized as cosmetic, either a change has been made in the way an application appears to the user or the programmer has been given different control of its appearance.

Most programmers will note a change in the naming of variables. dBASE III uses an underscore instead of a colon. In addition, the colon that dBASE II adds to prompts used with the ACCEPT and INPUT commands is gone in dBASE III; simply add a colon to the prompt message to simulate dBASE II's screen appearance. dBASE III also defaults the on-screen field delimiters to off, but they can be set on and can be changed from colons to other characters, such as "[]".

Although dBASE's messages, such as "100 records indexed," seldom appear in programs (usually SET TALK OFF is in effect), dBASE III does use more informative lowercase messages throughout in place of the cryptic upper-case messages of dBASE II. A new command, SET MENU ON, reminds the user of cursor and other edit functions during CHANGE, EDIT, and BROWSE command execution.

dBASE III features enhanced PICTURE capabilities for SAY and GET on-screen operations. PICTURE now has predefined macros for more flexible display and input of numbers and dates. It is also worth noting again that dBASE III increases the screen size, from 24 to 25 rows.

The end-user of an application will notice several differences between the behavior of dBASE III and that of dBASE II. One major change is in cursor motions between fields on the screen. dBASE II always positions the cursor to the start of a

TABLE 1: *Capacity Differences—dBASE II versus dBASE III*

	dBASE II	dBASE III
Number of fields per record	32	128
Total number of bytes per record	1,000	4,000
Number of records per database	65,535	1,000,000,000
Number of open database files	2	10
Total number of open files	7	15
Total fields accessible simultaneously (number of data files times number of fields)	64	1,280
Number of memory variables	64	256
Total number of bytes for memory variables	1,536	6,000
Numeric precision (number of digits)	10	15.9
Addressable screen size (column times row)	80x24	80x25
Type-ahead buffer size (characters)	0	19

TABLE 2: *Functional Differences—dBASE II versus dBASE III*

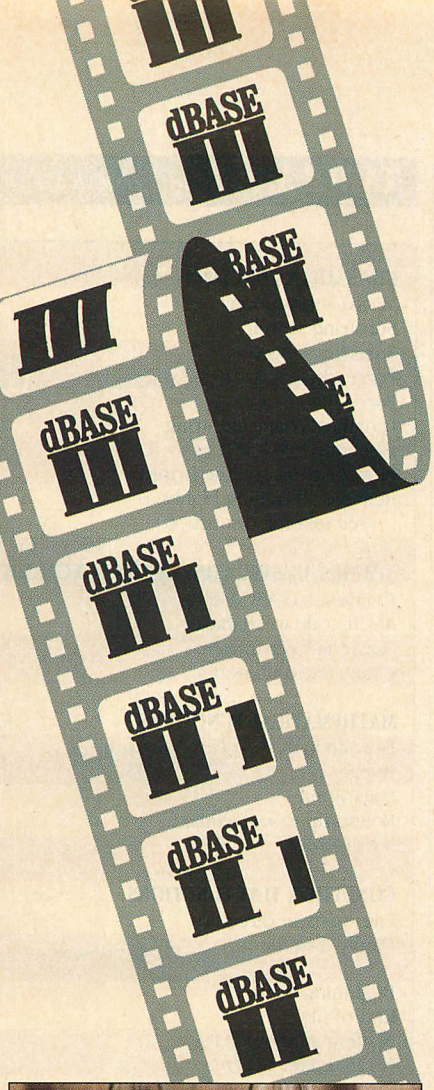
FEATURE	dBASE II	dBASE III
Character, numeric, logical variables	Yes	Yes
Date and memo variables	No	Yes
Valid field-name characters	A-Z, 0-9,:	A-Z,0-9,_
+,-,*,/ numeric operators	Yes	Yes
Square, square root, log, and exponent support	No	Yes
IEEE floating-point standard	No	Yes
Allow programmed video enhancements such as reverse video and bell	Yes	No
Extended character set support	Yes	Yes
Multi-field SORT command	No	Yes
Database filter	No	Yes
Unique key index support	No	Yes
Automatic relational positioning to second database	No	Yes
Modular program procedures	Yes	Yes
Memory variable scoping rules between procedures	No	Yes
Subroutine parameters	No	Yes
Procedure-file (library) support	No	Yes
System date and time support functions	No	Yes
Sub-directory filename support	No	Yes
Default directory path support	No	Yes
Display file directory, rename or erase files	Yes	Yes
DOS-like DIR, TYPE, and ERASE commands	No	Yes
Display disk space remaining	No	Yes
Command to copy any type of file	No	Yes
Run user-designated word processor for procedure (program) editing	No	Yes
Run other PC-DOS programs	No	Yes
Assembly language routine interface	Yes	No
Configuration file CONFIG.DB	No	Yes
Run-time package available	Yes	No

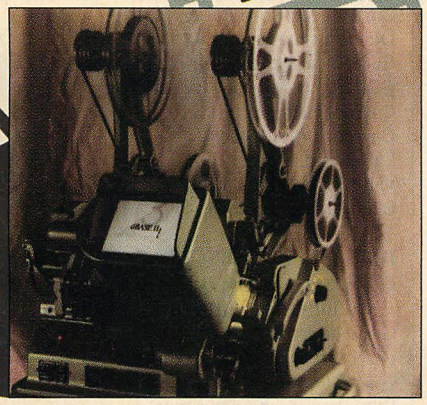
field when a between-field cursor movement is made; dBASE III does not. Instead, if the cursor is on position 50 of a 60-character string, keying the up-arrow or down-arrow will move the cursor to position 50 of the preceding or following character string (if it's that long). This makes editing a multiline text field group more like using a text editor. There is no word-wrap, of course, but in dBASE III, the cursor is more likely to go to where an experienced word processor expects it to go than it is in dBASE II.

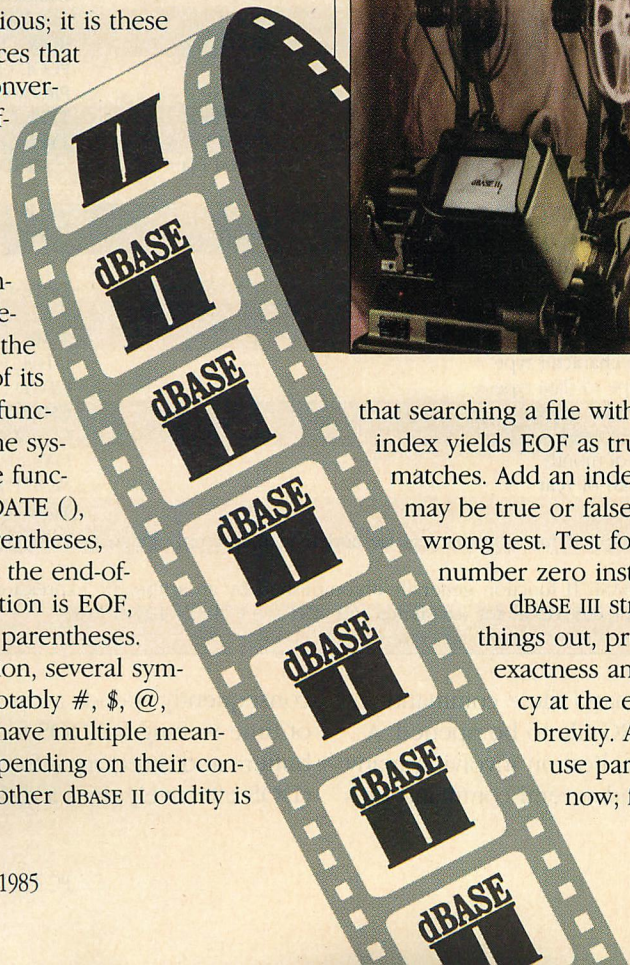
Another new feature of dBASE III that the end user will notice is the addition of a type-ahead buffer for smoother input. Finally, if logical variables are to be input from the keyboard with an INPUT command, users will have to type ".T." instead of "T" as before.

CONCEPTUAL DIFFERENCES

The cosmetic differences between dBASE II and dBASE III, on the screen and in the source file, stand out immediately. The conceptual differences between the two are less obvious; it is these differences that make conversions difficult. dBASE II is not particularly consistent regarding the format of its built-in functions. The system-date function is DATE (), with parentheses, whereas the end-of-file function is EOF, with no parentheses. In addition, several symbols—notably #, $, @, and *—have multiple meanings, depending on their context. Another dBASE II oddity is that searching a file without an index yields EOF as true for no matches. Add an index, and EOF may be true or false—it is the wrong test. Test for record-number zero instead.







dBASE III straightens things out, providing exactness and consistency at the expense of brevity. All functions use parentheses now; for example, "EOF" becomes "EOF()". Functions, rather than record pointers, are now always used for program control. Thus, the test for an empty file changes from "IF #=0" to "IF EOF() . AND. BOF()".

dBASE III offers two new variable types: dates and memo fields. Dates are stored internally as numbers, but can be represented as characters through date-conversion functions (table 3). Memo fields are record-related, variable-text fields that can be edited with the built-in editor or a user-designated word-processing program. They have limited programming use and no dBASE II analog, so conversion issues do not necessarily include them.

Table 3 also shows several new number routines: the exponential operator and the square-root, log, and rounding functions. As indicated, dBASE II applications requiring these functions could use add-on assembly language routines or more complex arithmetic expressions to perform these tasks.

Functions used to test conditions during programs are also shown in table 3. Again, all dBASE III functions take arguments, that is, use parentheses. This applies to the renamed character functions as well. Finally, memory variables are somewhat different in dBASE III. There are now PUBLIC and PRIVATE memory variables, to which scoping rules apply, as described below. A variable can also change its name between modules when it is used as a parameter. The programmer's attention with dBASE II is focused on the timely release of memory variables so that the program capacity of 64 such variables is not exceeded. With dBASE III, the programmer's focus is on retaining needed variables between modules rather than on releasing those that are no longer needed.

PROBLEMS SOLVED

Ashton-Tate claims that the speed of execution of dBASE II has been im-

proved in dBASE III, as a result of changes to the index and sort routines and of better buffer and overlay management. Background dirty-buffer processing is designed to reduce dBASE II's "Record out of range" problems, which result from improperly closed files and inconsistencies between a file's header information and its physical layout.

A desire for faster execution may motivate a conversion. Execution speed is, however, a measure of programmer performance as well as program performance. No benchmark tests were conducted for this article, but increased speed was apparent in the conversion case history presented later.

Other improvements to dBASE II are designed to make dBASE III easy to use. Extensive, graphic, and automatic help information is now available. It is quick and easy to use and serves as on-line documentation. The dBASE Assistant, an interactive command builder for occasional users of the direct-command mode of dBASE III, is also provided.

A user-specified text editor can be used by MODIFY COMMAND, which means that WordStar, for instance, is now run from dBASE III instead of dBASE II being run from WordStar. The CREATE/MODIFY STRUCTURE operation is now screen-oriented and automatically restores data after a MODIFY STRUCTURE. The built-in dBASE editor (the default for MODIFY COMMAND and MEMO fields) allows more powerful full-screen editing, although it has a 4KB buffer limit. These improvements do not, however, impact the conversion of programs from dBASE II.

A significant problem with PC-DOS is the momentary delay required to open a file, particularly on a floppy disk drive. When a new database is USEd, dBASE II must open the database and all of its associated index files. Each SET FORMAT TO command causes an .FMT file to be opened, and each DO <command file> command causes a .PRG file to be opened. A complex application involving many data files and several command files consequently spends a fair amount of time waiting for DOS to manage buffers and directory information. (DOS effectively does a disk system

TABLE 3: *Built-in Functions of dBASE II and dBASE III*

CHARACTER FUNCTIONS	dBASE II	dBASE III
Macro substitution	&	&
Substring search	@ ()	AT ()
Substring selection	$ ()	SUBSTR ()
Force upper case	! ()	UPPER ()
Force lower case	1	LOWER ()
Length of character string	LEN ()	LEN ()
Generate blank spaces	$ (STR(0,80),n)	SPACE (n)
Remove most trailing blanks	TRIM ()	—
Remove all trailing blanks (see text for distinction)	—	TRIM ()
STRING/NUMERIC CONVERSION FUNCTIONS		
Character to ASCII code	RANK ()	ASC ()
ASCII code to character	CHR ()	CHR ()
Numeric to character	STR ()	STR ()
Character to numeric	VAL ()	VAL ()
MATHEMATICAL FUNCTIONS		
Exponential	1	EXP ()
Integer	INT ()	INT ()
Logarithm	1	LOG ()
Round up to *n* decimals	2	ROUND ()
Square root	1	SQRT ()
CONDITION TEST FUNCTIONS		
File exists in directory	FILE ()	FILE ()
Empty data file	# = 0	BOF () .AND.EOF ()
Beginning of file	# = 0	BOF ()
End of file	EOF	EOF ()
No find after LOCATE	EOF	EOF ()
No find after FIND	# = 0	EOF ()
Current record number	#	RECNO ()
Deleted record	*	DELETED ()
Current screen column	—	COL ()
Current screen row	—	ROW ()
Current printer column	—	PCOL ()
Current printer row	—	PROW ()
Variable data type	TYPE ()	TYPE (' ')
Valid expression	TEST ()	TYPE ()
Blank field	TRIM (s)=' '	' '=TRIM (s)
DATE AND TIME FUNCTIONS		
Get user-set system date <returns char variable>	DATE ()	—
Get date from DOS <returns date variable>	1	DATE ()
Get system time	1	TIME ()
Date type to character type	—	DTOC ()
Character type to date type	—	CTOD ()
Date to calendar month	—	CMONTH ()
Date to day of week	—	CDOW ()
Date to day of month	—	DAY ()
Date to month of year	—	MONTH ()
Date to year	—	YEAR ()

[1]Denotes dBASE II function that can be added with assembly language subroutine or by PEEKs

[2]Denotes dBASE II function generally accomplished by an arithmetic expression such as "STORE n+.005 TO n" for data fields and "INT ((n+.005) * 100)/100.00"

reset each time a file is opened, which is why the RESET command previously used for CP/M-based dBASE II has disappeared.)

The redesign of dBASE III reduces the open-file delay in several areas. First, there are now ten user-named work areas. A *work area* is the functional equivalent of the dBASE II PRIMARY and SECONDARY areas. Each work area can accommodate an open database file, up to seven index files, a format file, and a relation (described later). Each work area also has its own internal record pointer and positional information available through the EOF() and BOF() functions. (A total of 15 files can be open at once, instead of the seven available in dBASE II). Effective programming techniques, discussed in the conversion case history, are required to take advantage of this design change.

The second major attack on the open-file delay problem is a technique that allows up to 32 command files, each one identified as a PROCEDURE, to be stored in a file, *a la* an application support library. When a procedure file is made known to dBASE III by the SET PROCEDURE TO command, it is opened and read entirely. The disk location of each procedure is then kept internally, so that each procedure can be accessed directly, thereby causing no file-open delay.

dBASE III has four elements to improve dBASE II's support for complex program development. Two are "extras" that do not directly affect conversions; two are major changes that require dBASE II source code to be reworked if it is to function under dBASE III.

One change that requires dBASE II source code to be substantially reworked has to do with the data-conversion functions that have changed in name and—for TRIM() and DATE(), at least—in function. Fortunately, the functional changes are largely mechanical and can be handled in an automated way.

The other change requiring substantial reworking of dBASE II code has to do with an entirely new dBASE concept: scoping rules for memory variables. This will be a problem in many conversions, one that will require careful thought and much retesting in order to finally resolve. *Scoping* is the notion that data are known only to their originating module and submodules (the modules they call with the DO command). The new dBASE III commands involving scoping are PUBLIC and PRIVATE; indirectly affected are SAVE and RESTORE. Variable-name precedence is a scoping-like concept that applies to memory variables and database field names. The rules are different for dBASE III and dBASE II, and these differences can cause some obscure problems.

dBASE III also supports DOS 2.0 functionality, as indicated in table 2. All file commands now support path names and the use of a user-defined directory search path. This means that commands such as "USE \accounting\inventory\parts" are now valid. To search the "\accounting\inventory" directory for files, simply use the command "SET PATH TO \accounting\inventory" (but be sure that the names of files to be accessed do not match those in the default directory, because it is always searched first). Multiple directories in the path are supported.

dBASE III provides access to the system date and time. It also has other DOS-like functions, including the ability to run other programs on command and then return to the next command line in the dBASE program. The COPY FILE command performs a DOS-like copy of any file, and the TYPE command displays a text file on the screen (stall with the left arrow key and abort with ESC instead of ^C). There is now a DOS-like DIR command that shows the amount of space left, and there is a DOS-like ERASE command. The dBASE II RENAME command works as before, completing the file management repertoire.

Four other major changes complete the transformation from dBASE II to dBASE III. Report creation and modification is now menu-driven and includes a screen-oriented report generator. A new mailing-label generator is similar to the new report generator. Labels can be created and changed easily, and records can be selected with FOR/WHILE clauses in the new LABEL command. Sample labels can be printed until the forms are aligned.

The dBASE III UPDATE command allows a random-order sequence for the source file and the use of update expressions for fields in the target file. BROWSE now has a built-in menu, better column headings, and "lock" and "freeze" features. UPDATE and BROWSE are discussed in detail later.

Scoping is the notion that data are known only to their originating module and their submodules (the modules data call with the DO command).

THREE CONVERSION STEPS

The conversion of a dBASE II application to a dBASE III application is accomplished in three steps:

1. Convert the dBASE II files to dBASE III files.
2. Correct the program files to solve ambiguities.
3. Reorganize the program files to take advantage of dBASE III's conceptual differences.

The first step is mechanical. The second step can either be trivial or a nightmare, depending on the complexity of the application and its suitability for conversion. All conversions must go through the first two steps. The third step, while it is not required, could result in increased capacity or functionality, improved speed of execution, easier maintenance, or perhaps a cleaner user interface. Ultimately, these are the goals of a conversion.

Step 1: Converting dBASE II Files to dBASE III Files. None of the data storage formats used by dBASE II is the same for dBASE III. Database files, as well as their index files, memory files, and report files, must all be changed for use with dBASE III. Fortunately, Ashton-Tate supplies the dCONVERT program with dBASE III to accomplish file conversions. dCONVERT also translates dBASE II program source files and format files into files that approximate their dBASE III equivalents. dCONVERT will do mass conversions (all files of particular type), and is menu-driven. Photo 1 shows its main menu.

dCONVERT is competent and easy to use. A file's format is inspected to prevent it from being converted twice. In each case, the original file is re-named so that only the last character of the file extension is changed (to a "B"); the created file otherwise takes the name of the old one. In this way, PAYROLL.DBB is the dBASE III form of the dBASE II file PAYROLL.DBF. dCONVERT detects existing back-up files and allows the user to manage the situation as desired.

Note item 7 on the menu (in photo 1). dCONVERT can be used to convert dBASE III database files to dBASE II form, provided the dBASE II file capacities and data types are compatible. One time during testing, the backwards conversion went through the motions (producing disk noises and messages) but failed to create a dBASE II file—no new file was created and the original dBASE III format was intact. Moral: don't trust dCONVERT entirely.

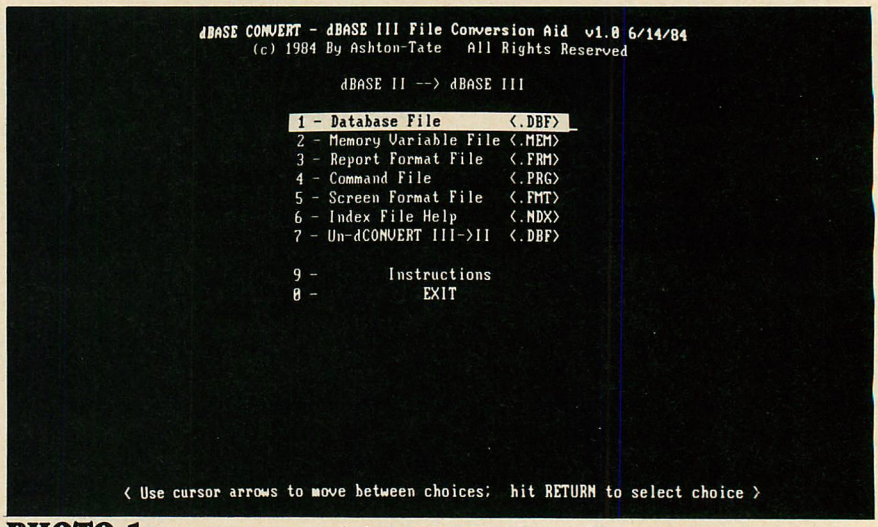


PHOTO 1: *Main Menu of dCONVERT*

Ashton-Tate claims that dCONVERT is a permanent part of dBASE III and is intended for more than dBASE II conversions. It can be used for porting data between dBASE III and other applications designed to use dBASE II file structures.

The dCONVERT program automates much of the conversion work, but it is not the only way to convert files. What follows is a discussion of what dCONVERT does for each type of file conversion. For each type, an alternate is given.

Database files are simply transformed by dCONVERT. Name the file (or use cursor pointing), and dCONVERT creates a dBASE III data file with a dBASE III-style file header and an identical structure. The alternative is to create an .SDF-type file from the original, using dBASE II. Do the same with the file structure and then use dBASE III to create a file from the structure file. Open the (empty) created file and read in the .SDF file that dBASE II created. This is, in fact, the method to use if dCONVERT fails to convert the dBASE III file back to a dBASE II file.

Index files are not transformed by dCONVERT. Instead, the index expression of the existing .NDX file's header is extracted. dCONVERT then creates a short command file that, when used with dBASE III, creates the index file. For example, PAYROLL.NDX is read by dCONVERT, and the index expression "emp:no+pay:per" is found. dCONVERT then creates this dBASE III command file:

```
* Index file rebuild help from
  dCONVERT
INDEX ON emp_no+pay_per TO
  payroll.NDX
```

This message is then displayed:

```
Use dBASE III to create a new index file.
USE correct database, then say DO
  payroll.RX to rebuild index file.
```

The alternative to using dCONVERT is to simply include a similar INDEX command within the application. Consider index files in relation to an entire application for a moment. There is no source-code documentation for the creation of an application's index file other than an INDEX command. The index file is a conceptual extension of the data file itself, and the application depends upon its correctness. Often enough, in dBASE II an index file

can become corrupted (presumably this happens less often in dBASE III).

It is good programming practice to have an application "take care of itself" with respect to index files. Each application developed here has a start-up routine, and in that routine is a construct similar to this for each index file:

```
IF .NOT.FILE('payroll.ndx')
  @ 12, 10 SAY 'Rebuilding index file
    PAYROLL.NDX. . . '
  USE payroll
  INDEX ON emp:no+pay:per TO
    payroll
  USE
ENDIF rebuilding index file
```

The index expression is now documented within the source code. Should the index become suspect ("Record out of range", etc.), the user's instructions are simple: delete all .NDX files and then rerun the application. More often than not the problem is solved.

Index files are also never backed up since it is safer to rebuild than to have the wrong one stored. As an added benefit, when the test payroll program was converted to dBASE III, no conversion of the index files was required.

Memory files are also simply transformed by dCONVERT. Name the file, and dCONVERT creates a dBASE III memory file. The alternative is to use a technique similar to that used for recreating index files. In an effort to make applications self-supporting, have the start-up routine check for the appropriate memory files. If they do not exist, create suitable memory variables and SAVE them to create the new memory file. Again, this documents the application within its source code. When the test payroll program was converted to dBASE III, the memory file did not have to be converted.

Report files, like memory files and program files, are simply transformed by dCONVERT. Name the file, and dCONVERT creates a dBASE III report file. The alternative to using dCONVERT is to recreate the report using dBASE III's full-screen report creator. Notes on how the original report was made will be needed, just as they would be if the file had to be recreated for dBASE II. At least with dBASE III, the report commands do not have to be memorized.

Program files are translated by dCONVERT. A simple transformation does not work, of course, because program source code has no predetermined structure to manipulate. The process of changing program files completes step 1 of the conversion procedure and continues through step 2 and step 3.

As with most of the other file types, the user names the file, and dCONVERT creates a dBASE III program file. dCONVERT counts the lines in the command file, adds a constant heading to each file, flags certain things, warns about others, and announces how many lines require attention.

dCONVERT can be used to convert dBASE III database files back to dBASE II form, provided the dBASE II file capacities and data types are compatible.

By and large, dCONVERT catches a lot, but it does not redesign the application. The application that uses six files and struggles to open and close them under dBASE II will use two work areas and struggle to open and close them under dBASE III. dCONVERT is fast, painless, and generally correct.

The alternative to using dCONVERT is to perform the initial pass manually, using a text editor. In any case, about two-thirds of the command files converted in the test cases discussed later required additional attention with a text editor. Each programmer's experience will best determine whether the initial dCONVERT effort is worthwhile.

So, dCONVERT does most things correctly, seldom does things wrong, and always seems to miss something. What exactly does it do? First, it places a three-line header of its own at the beginning of each output file. The lines read:

```
*!!* dBASE CONVERT - dBASE III File
  Conversion Aid v1.0 6/14/84*
SET HEADING OFF
SET SAFETY OFF
```

Unlike dBASE II, dBASE III places a field-name heading at the top of each response to the DISPLAY and LIST commands. The SET HEADING OFF command disables the field-name display. dBASE III also stops and asks the user if it is all right to delete a file when a new one of the same name is created. If an application creates new files without first deleting any old files that have the same names, dBASE III will stop and verify that the user really intends to de lete those files. (At any rate, that is the idea. For the version tested, which is the standard release version, SET SAFETY ON worked only at the keyboard command level, not during command-file use).

dCONVERT then reads through the file one line at a time, making syntactic changes. Refer to table 3 for a list of old functions and their new names. dCONVERT changes EOF to EOF(), # to RECNO(), and DATE() to DTOC(DATE()). dBASE II always returned a character string from the DATE() function, and dCONVERT does the functional equivalent. Every occurrence of T and F is changed to .T. and .F., so "DO WHILE T" becomes "DO WHILE .T.". At every contextually clear opportunity, dCONVERT changes colons to underscores.

References to the PRIMARY work area are replaced with "A" and those to the SECONDARY work area are replaced with "B". Thus, a phrase involving "p.emp:no" for dBASE II becomes "A->emp_no" for dBASE III. The "p.", "s.", and "m." references become "A->", "B->", and "M->" respectively. dCONVERT correctly preserves the colon in

```
@ 20,0 SAY 'Counts:'+. . .
```

Along the way, dCONVERT inserts warning comments into the output file at various points. For example, whenever FIND is used, dCONVERT inserts a warning:

```
*!! EOF( ) will be true if NO FIND, and
   RECNO( ) will equal BOTTOM, not
   0.
```

For each logical variable (T/F/Y/N) that is converted, dCONVERT inserts "*!! Logical constant converted." For commands such as "SET DATE TO &today" it makes the original line a comment and warns:

```
*!! 'SET DATE TO &today' is no longer
   valid.
*!! SET DATE TO &today
```

This latter warning counts in the "requires-attention" category included in the conversion-summary statistics dCONVERT produces for each file. dCONVERT's other warnings, not seen during the conversions done for this article, include:

```
NOUPDATE modifier is no longer
   required.
'SET LINKAGE . .' must be replaced
   with 'SET RELATION . .'
An alias may be required.
An alias is required.
The new 'ZAP' command is much
   faster than 'DELETE ALL/PACK'.
There will be no automatic colon
   following this prompt string.
'QUIT TO . .' is not supported.
Aliases 'P' and 'S' must be added to USE
   statement.
```

At its completion, dCONVERT reports the number of lines read, the percent converted, and the number of lines requiring attention. Tab characters are preserved in the output files. Examining the output file shows the first three lines inserted and a few warning lines, most of which, in the tests that were done for this article, warn about converting logical "T" to ".T." and about the results of a FIND.

In almost all cases, the actual test for the result of a FIND was *not* changed in any way, but test commands were close to the FIND commands. A few were in calling subroutines, which is tricky. Not all colon-to-underscore conversions were done. Those that were done were correct, meaning that dCONVERT errs on the conservative side: it does not change what it does not understand. The missed colons were in complex expressions:

```
IF RECNO( )>0 .AND.
   (gross__earn<>0. .OR.
   emp:expns<>0.)
LOCATE FOR ... .AND. (...OR.
   emp:expns<>0.)
STORE 24.*gross:earn TO y:gross
```

Interestingly, dCONVERT never changes a colon to an underscore after the GET clause in a command of the following construct:

```
@ row,col SAY 'Message ' GET
   emp:expns
```

Program files are translated by dCONVERT. A simple transformation does not work, of course, because program source code has no predetermined structure to manipulate.

Colons in comments and trailing comments ("ENDDO e:edit") are also left unchanged.

Step 2: Correcting Program Files to Eliminate Ambiguities. Each translated program file must be examined to assess the completeness of its conversion. The problems with colons mentioned above exemplify the kinds of things that need correcting and that are easy to change with a text editor's search functions.

Some other potential problems should be checked. For example, dCONVERT assumes that it has done its job by simply warning the user that the results of FIND commands might not test correctly in the dBASE II style. It is up to the user to find those tests and change them.

dCONVERT also does not warn that TRIMing a blank field in dBASE III results in a null string rather than a single blank string. This can be disastrous; every string tests true when compared to the null string!

```
IF TRIM(answer) = ' '
```

works with dBASE II, but will never work with dBASE III. Change it to

```
IF '' = TRIM(answer)
```

or its equivalent test,

```
IF LEN(TRIM(answer)) = 0
```

Sophisticated applications that use PEEK, POKE, SET CALL TO, and CALL will pass through dCONVERT unchanged and unnoticed. None of those functions works with dBASE III. In fact, as will be discussed later, no program that genuinely needs those functions can work at all under dBASE III.

dCONVERT has no contexting ability. Each line of each file is analyzed independently of others. One result of this is that the creation and release of memory variables, in consideration of the new variable-scoping rules, is a total miss. There is no way for dCONVERT to know about such things.

Beyond dCONVERT's translating abilities lie problems with screen

control, date variables, and outright dBASE II/dBASE III incompatibilities. These are the difficult or impossible conversion issues.

Screen control for dBASE II is different from that for dBASE III. If a programmer's application uses row 0 of the screen (even though the book said not to do that), he will have to rearrange things. dBASE II uses columns 19 through 25 for the INSERT-mode indicator. dBASE III has the same indicator displayed, but in a different place. The word "INSERT" appears in columns 46 through 51 (addresses 45 through 50), and columns 40 through 44 are erased ("*DEL*" appears there during EDIT, CHANGE, and BROWSE).

If the programmer changes his application to use dBASE III's RANGE clause of the @. . .SAY. . . GET command, then columns 40 through 80 of row 0 are used for the "Range is. . ." warning that appears when invalid data is entered. An undocumented remedy to unwanted "Range. . ." warnings does exist—SET SCOREBOARD OFF will suppress them.

To get input screens that look like those under dBASE II, be sure to include the command SET DELIMITER ON, because delimiters are normally off with dBASE III. In any event, every @. . .SAY. . .GET command will have to be changed for use with dBASE III, because dBASE III spaces over one column after every SAY message before positioning for a GET.

This is not as simple as omitting the customary trailing blank in the display messages (that is, changing "SAY 'Enter customer id' " to. "SAY 'Enter customer id'"). The positioning merely moves the cursor to that spot for input; any character left on the screen from previous messages will *not* be blanked out. Programmers who are used to overwriting one message with another have some work to do.

For the test conversions performed for this article, the trailing blank was left in place and a backspace—CHR(8)—was added to the end, for example,

```
SAY 'Enter customer id '+CHR(8)
```

Surprise! dBASE III uses the entire extended ASCII graphics character set, so CHR(8) does *not* back up the cursor one space as it does under dBASE II. Instead, a cute solid block with a black dot in the middle appears on the screen. Applications often ring the bell to signal the end of long calculations or to warn about invalid responses. For instance, when dBASE II executes either the command "?? CHR(7)" or the command "@ 23,10 SAY 'Invalid value '+CHR(7)", it rings the bell. dBASE III rings the bell for the first, but places a dot on the screen instead for the second.

An application that uses video attributes on the PC through assembly language routines (neither dBASE II nor dBASE III processes ANSI control sequences or passes them to the video driver) cannot be implemented with dBASE III, because dBASE III is currently unable to use assembly language routines.

dBASE III treats the new variable type DATE as numbers with a special display format. Internally, dates are stored as numbers, so they can now be treated arithmetically. When the system date is 01/15/84,

```
STORE DATE()+30 TO due_date
```

yields 02/14/84 as its result. dBASE III now has nine date functions (see table 3). All those dBASE II applications that convert dates to Julian dates will merit a lot of changes. Interestingly, now that date arithmetic is possible, dBASE III does not include direct Julian date functions. To create a Julian date for the current day (some day in 1984 in this example), use this expression:

```
STORE STR(84000+(DATE()-
  CTOD('12/31/83')),5) TO today_j
```

In fact, it may be desirable for dBASE II applications that use dates in Julian format to be converted so that they can use expressions such as this. dBASE III stores dates internally as YYYYMMDD, which is why date-type fields occupy eight bytes. For dates that span centuries, use the full year in the conversion, that is, use "CTOD('12/31/2001')" instead of "CTOD('12/31/01')".

Note that the date-to-year conversion function DTOC() creates dates of the form MM/DD/YY. To retrieve the actual four-digit year stored inside a date variable, use the YEAR() function. To set the year correctly internally, dates for years other than the 20th century must be entered as strings, such as '07/04/1776', and then converted to dates with the CTOD() function. This may be a lot of work, but the speed, accuracy, and extensive date formatting of dBASE III may be worth it. Optionally, handle dates only as strings, just as for dBASE II.

Table 4 shows the dBASE III equivalents for common dBASE II

For the version of dBASE III that was tested, which is the standard release version, SET SAFETY ON worked only at the keyboard command level, and not during command-file use.

code fragments, and table 5 shows reserved words. Try to avoid using dBASE III's verb or function names for variable names. Because dBASE III uses parentheses for every function, problems of precedence should not occur, and dBASE III has a better chance of figuring out what it is supposed to do. Nonetheless, some conversion problems may be caused by a poor choice of variable names. At least dBASE III, unlike dBASE II, will not go crazy with the statement STORE F TO T, because the distinction between "T" the variable and ".T." the programming constant is unambiguous.

Step 3: Reorganizing Program Files To Take Advantage of dBASE III's Conceptual Differences. After steps 1 and 2 of the conversion process, an application should function under dBASE III as it did under dBASE II. Step 3 is not required for a converted application to work, but it maximizes dBASE III's benefits.

Three areas in which redesigning a specific application can improve its performance were suggested by the earlier discussion of the conceptual differences between dBASE II and dBASE III: file openings can be reduced, memory variables can be used more flexibly, and code can be reduced by using more built-in functionality.

Data-file openings take time. With dBASE III they can be minimized in a number of ways. Ten work areas are now available instead of two, so use of the work area can be organized, and all files can be opened at the start of the program. Mid-program data-file USE commands should be changed to work-area SELECT commands. File structures should be revised to eliminate artificial relations.

Are the databases used with dBASE II truly relational or was a "relation" imposed by the 32-field limitation? Fewer index files or a revised index strategy could be used. Because dBASE III can index files much faster than dBASE II, an index used only for a monthly report is extra baggage. Create the index just before running the report.

Finally, determine the application's most frequently used program modules and place them in a procedure file. If code that is functionally identical has been placed in the application at several points just to reduce file openings, that code can be put in just one place and used at many points in the application. There is no time delay in using a procedure file, because it is opened only when SET.

dBASE III has new precedence rules between work areas and memory variables. Say the currently selected data file has a field named "emp_num", and a memory variable named "emp_num" has also been created; in the expression

STORE emp_num TO last_done

which of these two meanings of "emp_num" will be used?

The work area's current record is the source for the data used. This is true for both dBASE II and dBASE III. The two differ, however, in what takes place when a field in an *unselected* work area is named "emp_num". If the selected work area does not have a field named "emp:num", dBASE II will look for the field in the unselected work area before using a memory variable named "emp:num". dBASE III, however, does not check any unselected work areas. If the selected work area does not have a field named "emp_num", dBASE III will look for a memory variable named "emp_num" and use it.

This change in logic will cause some abrupt halts to applications that worked fine under dBASE II and translated with no problems. For this reason, it is best to combine data files in applications that use SET LINKAGE TO under dBASE II. dCONVERT switches areas when they

TABLE 4: *dBASE II/dBASE III Command Equivalents*

dBASE II COMMAND	dBASE III COMMAND
ERASE	CLEAR
CLEAR	CLEAR ALL
#	RECNO( )
SET RAW ON	<RAW is always set on>
SET RAW OFF	<use comma field separators> <or add blanks>
@ . . . SAY . . . USING '9,999.99'	@ . . . SAY . . . PICTURE '9,999.99'
SET DATE TO <date>	RUN DATE
SET COLON ON	SET DELIMITER ON
SET EJECT ON	<part of REPORT now>
SET HEADING TO . . .	<part of REPORT now>
UPDATE . . . ADD	UPDATE . . . <expression>
RESET <drive>	<not required in PC-DOS>
QUIT TO <command>	RUN <command>
@(string1,string2)	AT(string1,string2)
$(string,start,len)	SUBSTR(string,start,len)
!(varname)	UPPER(varname)
RANK(num)	ASC(num)
TYPE ('varname')	TYPE ('varname'])
TEST ('expression')	TYPE ([expression])

dBASE III uses the entire extended ASCII graphics character set, so CHR(8) does not back-up the cursor as under dBASE II.

TABLE 5: *Reserved Words/Symbols for dBASE II and dBASE III*

dBASE II AND dBASE III RESERVED WORDS/SYMBOLS			
$	EDIT	JOIN	RETURN
&	EJECT	LEN	SAVE
?	ELSE	LIST	SELECT
ACCEPT	ENDCASE	LOCATE	SET
ALL	ENDDO	LOCK	SKIP
APPEND	ENDIF	LOOP	SORT
BLANK	ENDTEXT	MODIFY	STORE
BOTTOM	EOF	NEXT	STR
BROWSE	ERASE	NOTE	SUM
CALL	EXTENDED	OTHERWISE	TEXT
CANCEL	FIELDS	PACK	TO
CASE	FILE	POKE	TOP
CHANGE	FIND	QUIT	TOTAL
CHR	FOR	READ	TRIM
CLEAR	GO	RECALL	TYPE
CONTINUE	GOTO	RECORD	UNLOCK
COPY	HELP	REINDEX	UPDATE
COUNT	IF	RELEASE	USE
CREATE	INDEX	RENAME	VAL
DATE	INPUT	REPLACE	WAIT

dBASE II and dBASE III RESERVED WORDS/SYMBOLS			
DELETE	INSERT	REPORT	WHILE
DISPLAY	INT	RESTORE	WITH
DO			
dBASE II RESERVED WORDS/SYMBOLS			
#	@	REMARK	TEST
*	LOAD	RESET	USING
!	RANK		
dBASE III RESERVED WORDS/SYMBOLS			
AT	DAY	MONTH	RUN
ASC	DELETED	PARAMETERS	SEEK
ASSIST	DIR	PCOL	SPACE
AVERAGE	DOW	PROCEDURE	SQRT
BOF	DTOC	PROW	SUBSTR
CDOW	EXIT	PRIVATE	UPPER
CLOSE	FREEZE	PUBLIC	TIME
CMONTH	LABEL	RECNO	YEAR
COL	LOG	ROUND	ZAP
CTOD	LOWER		

are declared (converting "p.xxx" to "A->xxx", for example), but note that dBASE code written for linked files probably does not use "s.varname" work-area syntax.

The dBASE II precedence order allows dBASE II to find fields in other work areas. dBASE III does not find them, however, so it is better to rework the application to do what the application required in the first place: that is, use more fields in a single data file.

As mentioned earlier, dCONVERT is blind to the creation and release of memory variables, but dBASE III has new variable-scoping rules that must be considered to make a conversion complete. Here is a method to get past the scoping problems without understanding them. First, run the translated application. If it has such problems, the application will stop with a message like this:

```
Variable not found
? 'The variable emp__num is
                    ?
  now '+emp__num
Called from  -  vartest.prg
Terminate command file? (Y/N)
```

The question mark above the command line is placed toward the end of the unresolved variable name. Somewhere "below" VARTEST.PRG, "emp:num" was defined under dBASE II. Under dBASE III, however, its definition was lost when the lower-level routine returned to its caller. It worked under dBASE II because all variables are global (known to all modules).

The dBASE III analog of dBASE II's global variables is the PUBLIC/PRIVATE status of variables. Edit the first module of the application and add the following line:

```
PUBLIC emp__num
```

Now run the application again and keep adding variable names to the PUBLIC statement until things work. In order to save testing time, simply enter the PUBLIC statement from the keyboard and then DO the application over again. The temporary effect is the same.

Suitable PUBLIC statements will bring an otherwise reluctant application to life under dBASE III. Is this better? Should PUBLIC variables be used? Actually, better programming results from PRIVATE variables.

How many command files have peculiar variable names, created in the hope that they were not used anywhere else? How many menus are within "DO WHILE e:menu-loop" loops? In dBASE III, *every* menu can now be placed within a "DO WHILE menu__loop" loop. The user declares "PRIVATE menu__loop" before the loop. The module that called can have its own "DO WHILE menu__loop" loop, but within the current module the value of the variable "menu__loop" is all its own. RETURN to the caller, and *its* value for "menu__loop" is restored.

Taking matters one step further, the calling module can pass information to the called module without requiring that both modules use the same variable names. This technique uses *parameters*, similar to subroutine arguments of traditional high-level languages. To get the variable-scoping benefits of dBASE III, analyze the application's use of memory variables and place PUBLIC and PRIVATE declarations in the code. Use parameters in subroutine calls where appropriate.

At this point, file openings have been reduced and memory variables are used more flexibly. Code can be reduced by using more built-in functionality offered by dBASE III. The new math functions are shown in table 3, and the new date functions were discussed un-

der step 2 above. Revising the application to use those functions may reduce code and increase speed.

Study the new PICTURE options to GET; "full-screen" data validation may often be substituted for many lines of dBASE II code. Do not neglect the new difference between "9" and "#" when used in PICTURE clauses. The RANGE option to GET may save code, too.

If the application uses indexed files, the new SEEK command can probably frequently be used in place of FIND. An example of its use is shown in table 6. If the application uses clever ways to do a locate within a locate, then consider using the new SET FILTER command in place of the "outer" use, keeping the LOCATE command for the "inner" use. The application may also do a lot of work to avoid reporting records with duplicate index keys. The new SET UNIQUE ON command takes care of that.

Memo data fields can be used in programs in limited ways. A memo field acts as a "black box" for text. dBASE III supports up to 4KB of text with its built-in editor, but any word-processing program, such as WordStar, can be used by specifying its name through the CONFIG.DB configuration file. The presence of memo data for a given record cannot be tested, and data within the fields cannot be examined. Memo data fields can, however, be displayed, printed, and edited from within a dBASE III program. Commands such as "DISPLAY memofield OFF" and "? memofield" can be used for the screen or printer.

Editing the contents of a memo field is more complicated. The following program fragment shows how it can be done:

```
SET MENU ON
STORE RECNO( ) TO where_at
CHANGE FIELD memo_data NEXT 1
GOTO where_at
```

During the CHANGE command, users are presented with a screen showing the field name and the cursor on the word "memo." To begin editing, they must press the Ctrl and PgDn keys, whereupon full-screen editing begins. To exit, they must press Ctrl and PgUp.

This inconsistent user interface can confuse first-time users. The dBASE II functional equivalent—multiple 65-character fields in a database—continues to be more viable in situations in which data must be examined by a program, or in which users are less sophisticated. With dBASE III's better cursor motions between fields and increased field capacity, multiline "text" within a database works better than it did with dBASE II.

The dBASE III analog of dBASE II's global variables is the PUBLIC/PRIVATE status of variables.

The BROWSE command was added to dBASE II version 2.3B as part of its upgrade to version 2.4. When I first saw it, I was excited. Here, for the first time I had ever seen, was a way of actually *showing* someone what it means to have a relational database. BROWSE shows the database as a two-dimensional table—fields appear as columns and records as rows. The screen becomes a window on the database that can be moved by the user vertically through records and horizontally across fields.

BROWSE is great for informal, nonprogrammed database use, but it is seldom useful in a program; it is not desirable, for instance, for a stock clerk to edit the part numbers when he is only supposed to maintain the quantities on hand. BROWSE cannot be used simply to view the data—it always allows the user to edit any and all of the data, with no programmatic restrictions even as simple as a format file.

dBASE III extends BROWSE so that it becomes almost useful in programs. The FIELDS clause allows the program to specify which fields will be viewed and in what order. The following two clauses are not indicated in the documentation and are only implied on the pop-down menu screen (SET MENU ON) during browse, but they do work: LOCK and FREEZE <field>.

LOCK allows a number of columns (data fields, not character positions) located on the left side of the screen to be kept as part of the display. The right side scrolls horizontally while the left is locked, much the same way that spreadsheet program works. First, the part number and descriptions are specified, then LOCK 2 is specified for those two fields, and finally, the other fields can be scrolled horizontally in any order.

FREEZE <field> limits the user's ability to edit (and to position the cursor) to a single field. The fields can still be scrolled horizontally, and, of course, the records scrolled vertically. This allows program control over those fields that are edited by the user. For example, FREEZE QTY_ON_HAND would allow a stock clerk only to change quantities while viewing part number and description. BROWSE thus becomes a powerful nonprocedural command to include the informal applications.

Because dBASE III allows more database fields (128 total) than dBASE II does (32 total), it is easy to

TABLE 6: *Undocumented Alternative Commands*

NOT-DOCUMENTED ALTERNATIVE COMMANDS

dBASE II	dBASE III
USE	CLOSE
SET INDEX TO	CLOSE INDEX
SET FORMAT TO	CLOSE FORMAT
SET ALTERNATE TO	CLOSE ALTERNATE
DISPLAY FILES	DIR
DISPLAY FILES LIKE *.ndx	DIR *.ndx
DELETE FILE filename	ERASE filename
COPY TO tmp STRUCTURE EXTENDED	COPY TO tmp STRUCTURE EXTENDED

DOCUMENTED ALTERNATIVE COMMANDS

dBASE II	dBASE III
STORE n+1 TO n	n = n+1
STORE ' " '+cust:id+po:num+' " '; TO f:key	SEEK cust-id_po_num <no quotes required in expression>
FIND &f: key <quotes required for macro>	
DELETE ALL / PACK	ZAP

conceive of adding a special one-character field VIEW to a database, so that BROWSE can be used with a FREEZE VIEW clause. Doing so allows only the value of VIEW, a nonsense field, to be edited, while it is allowing the user to pan the entire database. The program thus allows access to the entire database (or selected fields) while permitting editing in none of the fields.

UPDATE is much more functional in dBASE III than in dBASE II, although its improvement is not even mentioned in Ashton-Tate's change summary. A new RANDOM clause allows the source database to be in any order, provided the target database has a suitable index. Also, the "REPLACE <field> WITH <expression>" clause accepts any valid expression and can include references to fields that are located within the target database.

Lastly, the usable dBASE array has arrived. No, it's not mentioned in the ads or in the manual, but it's there. Think for a moment. A data array is an ordered set of values. Each particular value is located by position within a "list." Many programmers use long character-string memory variables as dBASE "arrays," using the substring function to isolate individual elements. Such arrays work fairly well (they do their job) but they are difficult to maintain, tricky to program, and limited to precious (under dBASE II) memory variable space.

With dBASE III's better cursor motions between fields and increased field capacity, multiline "text" within a database works better than with dBASE II.

I was initially frustrated by dBASE II's limited number of memory variables, so I created one-record database files several years ago as a last resort to acquire more storage space. The database technique works quite well, although it does require another file to be opened, this causes a time delay.

I soon realized that a database is dBASE's "native" array structure. In fact, for a list of valid states—a database with one field of a mere two characters and about 50 records— after the file is opened and read once, the disk is never accessed again. The entire file is memory resident in dBASE's disk buffers. Using disk storage for the array slows the program; otherwise, the concept works reasonably well.

With dBASE III, the time problem with using database arrays is solved. Simply use one of the ten work areas for the database array, and the need to close and reopen the database array is eliminated.

Arrays are generally used for two purposes: to validate a value from a data input or edit and to fetch one predefined value corresponding to another (a table look-up). The first use is programmed the same for dBASE II and dBASE III

```
dBASE II:
SELECT SECONDARY
LOCATE FOR state = p.state
STORE #>0 TO valid:st
SELECT PRIMARY

dBASE III:
SELECT states
LOCATE FOR state = cust->state
STORE .NOT.EOF( ) TO valid_st
SELECT customer
```

A table look-up is done in much the same way with dBASE II. It can be very different with dBASE III, however, for the SET RELATION command allows database arrays to be used in a more subtle, nonprocedural way than they can be in dBASE II. For example, assume that two files, CUSTOMER and STATES, have a relation through the field STATE. One record in the CUSTOMER database is related to another record in the STATE database that matches the value of the STATE field. Figure 1 shows the dBASE III status and the file structures.

Figure 2 demonstrates how SET RELATION allows the nonproce-

dural command LIST to use two files simultaneously. (Note that the column headings dBASE III uses are taken from the command line itself; this means that selective upper case can be used.)

Now think of how much easier multifile reports are with the SET RELATION capability. A database can have only one relation at a time, but a related file can, in turn, have a relation to another. The example above can be extended with a third file, SALESREP, which relates a sales person to each state in the STATES database (see figure 3).

This three-file relationship allows these commands to be added to the example above:

```
SELECT states /
  SET RELATION TO
  state INTO salesrep
SELECT customer
LIST State,states->Name,salesrep->
  Last_Name
```

For relations from one file to more than one other file, a program must actively switch between relations. Here's how that works:

```
SELECT states
? state+' '
SET RELATION TO state INTO states
?? states->name+' '
SET RELATION TO state INTO salesrep
?? salesrep->last_name
```

SET RELATION, therefore, automatically SELECTs, FINDs, and then reSELECTs. Notice also that integrity between databases is assumed—that is, the existence of a record in each database that relates to the others is assumed. When dBASE III finds no match, the required field will then be treated as blank.

Multiple work areas allow faster and more practical use of database arrays as described above. With SET RELATION, as shown, the searching of an array for a match can be nonprocedural. In this sense, an old problem dBASE II—the lack of arrays—is overcome by dBASE III's automatic look-up of array values. For superior speed, use the new COPY FILE command at the start of an application to place such databases and their index files in a RAM disk.

A CASE HISTORY

As a test of the conversion process, a working dBASE II payroll program was modified to work with dBASE III. dCONVERT was used to transform all the data files and to create the initial translation of the source code. The four data files and one memory file were translated quickly and correctly, and the short command files created to recreate the three index files were correct.

In fact, for a list of valid states—a database with one field of a mere two characters and about 50 records—after the file is opened and read once, the disk is never accessed again.

When the data files were converted back to dBASE II form, three were correct and one was never completed, as recounted above. The optional method described above was used to recreate the dBASE II form of the reluctant datafile. After the source code was converted, the optional methods of creating the memory and index files were successful (those methods were already part of the application).

dCONVERT translated the 18 program modules (2,493 lines) in a few minutes. Only one module was noted by dCONVERT as requiring attention: the module that set the system date. Ultimately, six of the modules were left as translated by dCONVERT, and the others required manual editing. dCONVERT inserted 115 of its own comment lines. Most warned of logical-constant conversions (all were correct); the others warned about testing results of a FIND operation (each such operation required a manual edit to change "RECNO() > 0" to ".NOT.EOF()").

Only 70 lines required any edits to make the application syntactically correct; most of these were to fix missed colon-to-underscore translations. Each module except the main module was edited to remove the dCONVERT heading. The dBASE III configuration file, CONFIG.DB, was edited to turn off intensity, bell, and help and to turn on delimiters, so no commands to do so were added.

At this point, the payroll system was run, and a serious problem with variable scoping was found immediately: variables restored from a .MEM file are set PRIVATE. Setting them PUBLIC in a higher module was overridden with the "RESTORE FROM mem-save" command, so a solution was needed. The old code

```
RESTORE FROM mem-save
```

was replaced by

```
CLEAR MEMORY
PUBLIC comp_name,...<etc>
RESTORE FROM mem-save ADDITIVE
```

Note that the variables must be declared PUBLIC *after* the memory variables have been cleared and that ADDITIVE must be part of the RESTORE command; otherwise, an internal CLEAR MEMORY is performed and the PUBLIC status is lost (pretty nasty).

Once this was discovered, two lower-level modules were changed to include PUBLIC statements for the data they returned to their callers. Throughout the application, "emp_num = ' '" is used to determine whether the low-level routine found an employee or whether it were time to quit. The low-level

Imagine dBASE III™ running up to 20 times faster.

The time for Clipper has arrived.

Clipper introduces you to the time of your life.

Time is your most valuable commodity. Because how you spend your time, is how you live your life.

At Nantucket, we believe you should live life to the fullest.

Clipper, the first true compiler for dBASE III,™ is a timely example. Now, dBASE compiled by Clipper runs 2 to 20 times faster than dBASE with its standard interpreter.
A dBASE interpreter painstakingly checks and executes your source code one line at a time, every time you run a program. With Clipper, once you've debugged your source code, it's compiled into more efficient machine code. Your program runs without the time-consuming overhead of redundant translation. Clipper compiles all your existing and future dBASE III programs.

Developing a compiler for dBASE III was just a matter of time. Call your dealer or our toll free 800 number and ask for Clipper.

Then go make the most of your life time.

Nantucket

20456 Pacific Coast Hwy., Malibu, Ca. 90265 (800) 556-1234 ext. 225. In California (800) 441-2345 ext. 225

CIRCLE NO. 217 ON READER SERVICE CARD

dBASE III is a registered trademark of Ashton-Tate

routine was thus fixed to set "emp_num" to a single blank if TRIM(emp_num) was a null string. The necessity of using data for program control (tch!) is one consequence of having only 64 memory variables under dBASE II.

After these corrections were made, the application ran correctly, but the screen was messy. All the SAY. . .GETs were off by one position, as detailed above, and the characters in the middle of all the nicely centered messages on row 0 of the screen were erased.

In dBASE III, numeric variables must be initialized with the proper number of decimal places. This was discovered as a result of setting the employee hours to 0 and trying to read them with this command:

```
PICTURE '99.99'
```

In dBASE II, the PICTURE clause overrides the initial setting; in dBASE III it does the reverse. After a little experimentation and switching between dBASE II and dBASE III, the proper command was found:

```
STORE 0.00 TO hrs_worked
```

And I thought it was a numeric variable! The PICTURE was also changed to '##.##' to allow leading blanks ('9' and '#' have different meanings in dBASE III). At this point, an application designed for dBASE II was working with dBASE III.

A test file was then set up to calculate taxes for 100 records. Because the tax calculation juggles three files at once, the design had to be changed so three work areas could be used. USE commands were changed to SELECT commands as described above. The tax calculation itself involves using LOCATE commands in order to determine the tax bracket above the pay rate and then backing up one.

To keep only one file open, all government jurisdictions and withholding groups are put in a single file, when in fact there are five combinations altogether. Recognizing this, the tax calculations were changed to use five tax-table files instead of just one—this produced shorter files, faster locates, but more work areas. Table 7 shows the cumulative results.

This table is not a true benchmark. In real life, this application calculates only 30 to 40 taxes per month, so the tax routine was written for simplicity first and performance second. These times do,

FIGURE 1: *CUSTOMER and STATES Files*

dBASE III STATUS

Currently selected database:
Select area - 1, Database in use: customer.dbf Alias - CUSTOMER
Related to: STATES
Select area - 2, Database in use: states.dbt Alias - STATES Index file: states.ndx key - state

FILE STRUCTURES

Structure for database: customer.dbf
Number of data records : 5

FIELD	FIELD NAME	TYPE	WIDTH	DEC
1	LAST_NAME	Character	10	
2	FIRST_NAME	Character	10	
3	ADDRESS	Character	20	
4	CITY	Character	14	
5	STATE	Character	2	
6	ZIP	Character	5	
TOTAL			62	

Structure for database : states.dbf
Number of data records : 10

FIELD	FIELD NAME	TYPE	WIDTH	DEC
1	STATE	Character	2	
2	NAME	Character	14	
3	TAX_RATE	Numeric	5	
TOTAL			22	

FIGURE 2: *Using SET RELATION and LIST to Use Two Files Simultaneously*

```
SET RELATION TO state INTO states
LIST City,State,states→Name,states→Tax_Rate
```

RECORD #	CITY	STATE	STATES→NAME	STATES→ TAX RATE
1	Bloomington	IN	Indiana	7.00
2	Muskegon	MI	Michigan	5.00
3	Raleigh	NC	North Carolina	3.00
4	Roanoke	VA	Virginia	3.75
5	Knoxville	TN	Tennesee	4.30

FIGURE 3: *SALESREP*

Structure for database : salesrep.dbf
Number of data records : 23

FIELD	FIELD NAME	TYPE	WIDTH	DEC
1	LAST_NAME	Character	10	
2	FIRST-NAME	Character	10	
3	STATE	Character	2	
TOTAL			22	

however, illustrate an important point of application conversions: converting through steps 1 and 2 may realize no performance benefit, whereas converting through step 3 may realize benefits—in this case a 16-percent savings in tax calculation time was realized by using more work areas.

THE PRICE OF CONVERSION

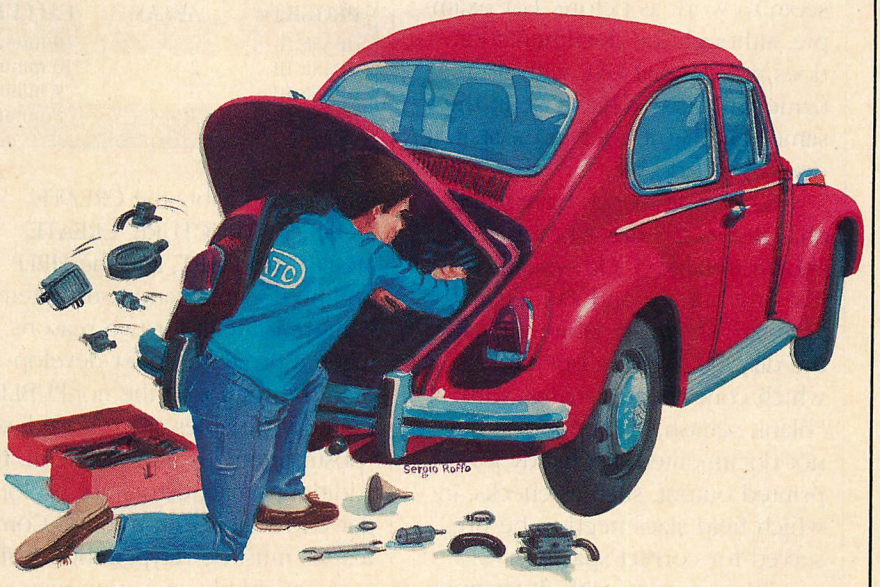
dBASE III offers greater capacity and functionality than dBASE II. An application running under dBASE II must require dBASE III's improvements for it to be a suitable candidate for conversion. The conversion process is not just one of transforming data files; it requires overcoming the differences in program behavior between dBASE II and dBASE III if the application is to function identically afterward. The time and expertise required to overcome those differences is the price of conversion.

Bob Byers, author of *Everyman's Database Primer*, began a recent lecture on dBASE conversions by stating, "If you were good programmers, you're now going to pay the price." What he means is that simple programs convert easily, whereas others probably will merit a total redesign.

Along the conversion route are several programming hardships. Previous sections of this article suggest answers to questions such as "Where did my memory variables go?" and "Where did my alternate database fields go?" Other questions have not been touched upon, such as "Where did my pre-allocated disk space go?" (PACK now releases unused disk space if there is enough room to copy the file and then delete the old one).

There are undocumented mysteries, to be sure. READ now seems to do an internal CLEAR GETS so that GETs cannot be recycled (generally more a nuisance than a convenience). EJECT now hangs up the system if the printer was off, and the release notes warn that a "DO

Still Fixing Bugs The Hard Way?



Ready to take the sting out of debugging? You can with Pfix86™ and Pfix86 Plus™, the most advanced dynamic and symbolic debuggers on the market today for PC DOS and MS-DOS™ programmers.

What other debugger offers you an adjustable multiple-window display so you can view program code and data, breakpoint settings, current machine register and stack contents all at the same time? And, an in-line assembler so you can make program corrections directly in assembly language. Plus, powerful breakpoint features that allow you to run a program at full speed until a loop has been performed 100 times, or have the program automatically jump to a temporary patch area.

Or maybe you're tired of searching through endless piles of listings for errors? With Pfix86 Plus you won't have to. You can locate instruction and data by the symbolic name and using the symbolic address. Handle larger, overlayed programs with ease. And, Pfix86 Plus is designed to work with our Plink86™ linkage editor.

But that's not all. With a single keystroke you can trace an instruction and the action will be immediately reflected in code, data, stack, and register windows. Pressing a different key will elicit a special trace mode that executes call and loop instructions at full speed, as though only a single instruction were being executed.

And you get an easily accessible menu that makes the power of our debuggers instantly available to the new user, but won't inhibit the practiced user.

So, why struggle with bugs? Pfix86 by Phoenix. Pfix86 $195. Pfix86 Plus $395. Call (800) 344-7200, or write.

Phoenix

Phoenix Computer Products Corporation
1416 Providence Highway, Suite 220
Norwood, MA 02062
In Massachusetts (617) 762-5030

Pfix86, Pfix86 Plus and Plink86 are trademarks of Phoenix Software Associates Ltd.
MS-DOS is a trademark of Microsoft Corporation

CIRCLE NO. 161 ON READER SERVICE CARD

WHILE &expression" only does it once. One pertinent question is, "Do the old ways of doing things still work?" Most of the old ways, other than those noted here, *do* seem to work as before. For example, although the documentation does not say that USE with no filename will close a database in the same way that it does in dBASE II, it does in fact do so.

Some commands have to be changed to the dBASE III form, as shown in table 5. Others still work just fine but are undocumented. They are shown in table 6. Finally, the dBASE II '-' string operator, which concatenates strings with "blank squash," is supported but not documented. It's handy for printed output, such as checks, in which field sizes need to be preserved for correct spacing.

Programming with dBASE III is both easier and more difficult. It is easier because of the increased capacity and some screen-oriented functions, notably the CREATE/MODIFY STRUCTURE, CREATE/MODIFY REPORT, and the HELP on-line documentation subsystem. It is more difficult for two reasons: when a program under development blows up, all the nonPUBLIC memory variables are released, so a "postmortem" is more difficult. In addition, syntax errors are no longer correctable "on the fly." Commands must be retyped, but during a command-file execution they can no longer be corrected; programmers must either push onward and hope for the best, ignoring such commands, or abort the execution, causing the variables to be released.

TABLE 7: *Cumulative Results of Tax Calculation*

PROGRAM	WORK AREAS	EXECUTION TIME FOR 100 TAX CALCULATIONS	SAVINGS	PCT. OF dBASE II
dBASE II	2	10 minutes, 20.0 seconds	—	100
dBASE III	2	10 minutes, 15.2 seconds	5 sec	99
dBASE III	3	9 minutes, 59.0 seconds	21 sec	97
dBASE III	7	8 minutes, 43.5 seconds	97 sec	84

The remedy to the forgotten-variables problem is to develop different work habits: declare critical variables PUBLIC from the keyboard or at the start of a program, and they will be preserved. The traceback facility still displays an offending command and its module hierarchy (where the program is and who called whom).

CONVERSION: PRO AND CON

If an application requires the greater capacity or functionality that

WAVE MATE BRINGS MUSCLE TO YOUR IBM PC/XT WITH IT'S 80286 MOTHERBOARD

BULLET-286 makes the XT perform with greater power and speed than the IBM PC/AT

It's the new **BULLET-286** motherboard for the IBM PC/XT marketplace. This advanced-technology product utilizes the Intel microprocessor 80286 while maintaining both hardware and software compatibility with the IBM PC/XT. By simply replacing the existing XT board with our new **BULLET-286,** you get greater power and speed than the IBM PC-AT. Thus, existing PC/XT users can preserve their investment in hardware and software while moving a quantum leap beyond PC-AT performance.

The **BULLET-286** contains a 6 megahertz no wait state 80286 microprocessor in place of the XT's 4.77 MHz 8088. There is an 80287 math co-processor option, 8 IBM expansion slots, and enhanced ROM BIOS. The **BULLET-286** is equipped with 256K bytes of memory, expandable to 1 megabyte on-board.

The **BULLET-286** is compatible with the IBM PC/XT to a degree far beyond the IBM PC-AT product. Application programs and operating systems (PC-DOS, CP/M, UCSD Pascal, Pick, Oasis, Unix-derivitives) available for the XT, can run without incompatibilities on the **BULLET-286.**

You can order now. The **BULLET-286** is available with 256K RAM, with options to 1 full megabyte. Prices start at $1,995.

Quantity discounts available. OEM and dealer inquiries welcome.

APOLLO MARKETING

(a division of Cal. Digital)
22048 Sherman Way #316
Canoga Park, CA 91303
Tel: (818) 883-8390
Telex: 194369
In Europe call: Brussels 32 2 649-1070

CIRCLE NO. 180 ON READER SERVICE CARD

Potent Pascal.

Microsoft® Pascal may be the most powerful software development environment available for the MS™ DOS system. It combines the programming advantages of a structured high-level language with the fast execution speed of native code compilation.

And it exceeds the proposed ISO and ANSI standards with logical extensions that make the language more powerful and versatile. For example, programming capabilities even allow you to manipulate data at the system and machine level.

It gives you single and double precision IEEE floating point arithmetic. Numeric operations take advantage of the 8087. Or automatic software emulation is provided if the coprocessor is not installed.

Support for long heap allocation and separate module compilation gives you the flexibility to create large programs up to one megabyte.

And the standard linking interface makes it easy to combine Microsoft FORTRAN or assembly language subroutines.

Call 800-426-9400 to order the potent Pascal. $300*

In Washington State, call 206-828-8088. Ask for operator C5, who will rush you your order, send you more information, or give you the name of your nearest dealer to see Microsoft Pascal in action.

MICROSOFT®
The High Performance Software

*Price exclusive of handling and Washington State sales tax.

Microsoft is a registered trademark and MS is a trademark of Microsoft Corporation.

is offered by dBASE III, and if the price of conversion is justified by the benefits, then it would seem that the case for conversion from dBASE II to dBASE III is clear.

There are, however, reasons for leaving an application in dBASE II. If an application presently uses assembly language routines, PEEKS, or POKES (those not replaced by dBASE III's math and date functions), then conversion is presently not possible. Pretty screens and displays that are achieved through assembly language routines cannot be duplicated. Programmers who are paranoid about hardware or media failure and prefer to run with VERIFY ON (DOS read after write) may not want to use dBASE III. The ProLock software copy protection requires VERIFY to be set OFF. If it's ON, ProLock thinks the system disk is an unauthorized duplicate.

Other drawbacks to dBASE III are that the help file can no longer be customized to an application (but that problem can be circumvented) and that dBASE III apparently cannot support remote use (the use of a system via a modem). Finally, dBASE III requires DOS 2.0 and 256KB. In some cases an upgrade may not be justified.

Programmers who develop applications software for sale to others will be concerned that dBASE III has no runtime system as yet.

Programmers who develop applications for sale to others will be concerned that dBASE III has no runtime system as yet. Also, if a dBASE II application integrates with data files from Ashton-Tate's Friday!, the data files will have to be converted for use with dBASE III, at least until a dBASE III version of Friday! is released. But take heart—Friday! uses the dBASE II's RunTime system, and the SET SCOREBOARD OFF command was put in dBASE III because the Friday! development group asked for it. Draw your own conclusions.

Ashton-Tate's first release of dBASE III is clearly intended to remedy dBASE II's shortcomings as seen in the marketplace. The company's research shows that more than half the users of dBASE II *never use command files*. Therefore, it is understandable that dBASE III is tailored to meet the needs of novice users rather than those of programmers who view dBASE as a language. Users can probably expect to see cycles of "novice" and then "programmer" releases. If that happens, the next release of dBASE should be for programmers.

8087 AND 80287 TECHNICAL TOOLS

87FFT™ performs Forward and Inverse FFTs on real and complex arrays which occupy up to 512K bytes of RAM. Also does convolutions, auto correlations, hamming, complex vector multiplication, and complex to radial conversions. Callable from MS Fortran or 87BASIC/INLINE..... **$150**

87FFT-2™ performs two-dimensional FFTs. Ideal for image processing. Requires 87FFT...**$75**

MATRIXPAK™ manages a **MEGABYTE!** Written in assembly language, our runtime package accurately manipulates large matrices at very fast speeds. Includes matrix inversion and the solution of simultaneous linear equations. Callable from MS Fortran 3.2, 87MACRO, 87BASIC/INLINE, and RTOS..... each **$150**

DATA ACQUISITION PACKAGE
Interactive, user-oriented language which allows the acquisition and analysis of large data streams..... **CALL**

GRAPHICS PACKAGES
Energraphics (stand alone)..... 295
Grafmatic for MS Fortran or Pascal..... 125
Plotmatic for Grafmatic..... 125
Halo for Basic, C or Fortran..... each 150

OTHER TOOLS
Alpha Software ESP..... 595
Borland Sidekick, Toolbox, or Graphics..... 45
COSMOS Revelation..... 850
Lattice C..... 299
PSI MATHPAK..... 75
smARTWORK..... 895
SPSS/PC..... 695
STSC APL★PLUS/PC..... 475

RTOS - REAL TIME OPERATING SYSTEM
RTOS is a multi-user, multi-tasking real time operating system. It includes a configured version of Intel's iRMX-86, LINK-86, LOC-86, LIB-86, OH-86, and MicroWay's 87DEBUG. Runs on the IBM-PC, XT, PC-AT and COMPAQ..... 400

INTEL COMPILERS[1]
FORTRAN-86..... 750
PASCAL-86..... 750
PL/M-86..... 500
87C (LATTICE/MICROWAY)..... 750
ASM-86..... 200

URS™ - Universal Run Time System[1]
Generates programs with the Intel compilers which run on other operating systems. MS-DOS version is included with RTOS.
Xenix-286 Version..... 300

SoftScope Symbolic Debugger[1] 500
[1]Requires RTOS or iRMX-86. All Intel compiler names and iRMX-86 TM Intel Corp.

87BASIC/INLINE™ converts the output of the IBM Basic Compiler into optimized 8087 inline code which executes up to seven times faster than 87BASIC. Supports separately compiled inline subroutines which are located in their own segments and can contain up to 64K bytes of code. This allows programs greater than 128K! Requires the IBM Basic Compiler and Macro Assembler. Includes 87BASIC..... **$200**

PC AT and 86-310 DRIVES
30 MEGABYTE WINCHESTER..... 2000
53 MEGABYTE WINCHESTER..... 2600
SYQUEST FIVE MEGABYTE..... 950

HARDWARE AND LANGUAGES
8087-3 5mhz..... $149
Including DIAGNOSTICS and 180-day warranty
For IBM PC and compatibles
8087-2 8mhz..... $275
For Wang, AT&T, DeskPro, NEC, Leading Edge
80287-3 5mhz..... $275
For the IBM PC AT
64K RAM Set..... $30
256K RAM Set..... $195
128K RAM Set PC AT..$225
NUMBER SMASHER™..CALL
10mhz 8087 coprocessor board for the IBM PC

FORTRAN and UTILITIES
Microsoft Fortran 3.2..... 239
IBM Professional Fortran..... 595
Intel Fortran-86[1]..... 750
FORLIB+..... 65
STRINGS and THINGS..... 65

BASIC and UTILITIES
IBM Basic Compiler..... 270
87BASIC/INLINE..... 200
Summit BetterBASIC™..... 175
Summit 8087 Module..... 87

MACRO ASSEMBLERS
IBM Assembler with Librarian..... 155
87MACRO..... 150

PASCAL
Microsoft Pascal 3.2..... 209
Borland Turbo..... 45
Turbo with 8087 Support..... 85

NO CHARGE FOR CREDIT CARDS
ALL ITEMS IN STOCK
CALL FOR COMPLETE CATALOG

MicroWay P.O. Box 79 Kingston, Mass. 02364 USA (617) 746-7341

You Can Talk To Us!

CIRCLE NO. 174 ON READER SERVICE CARD

SCREEN SCULPTOR™

GENERATES CUSTOMIZED INPUT SCREEN PROGRAMS IN BASIC AND PASCAL . . .

THE SOFTWARE BOTTLING COMPANY OF NEW YORK

BASIC or PASCAL. Easily!

Generate programs in **BASIC** or **PASCAL.** Your **choice.** Works with * **Turbo PASCAL,** * **IBM PASCAL** or **IBM BASIC** (Interpreter and Compiler). **Easy** to use.
Begin productive use in minutes!

POWERFUL SCREENS

Everyone can have **professional quality screens** to dress up any program. Generate **complex, colorful, effective** screens in minutes.

FULL FUNCTION SCREEN CREATION

Simply **"draw" input screens** with word processor style editor.

Advance screen creating features include:

- **Draw boxes, lines, etc.** in seconds with unique character selection menu.
- **Repeat last character** in any direction.
- Special **color-select screen** displays all available colors.
- **Paint and Repaint** sections of screen at any time.
- **Copy** and **Move** sections of screen.
- **Insert** or **Delete characters** and **lines.**
- **Input field definition** screen gives you **total control** of character type definitions, edit screen masks, input sequence, variable names, initial values, protected characters, etc.

COMPLETE DATA ENTRY ROUTINES

Generates customized program code that allows **professional quality** data input using the full PC keyboard **(cursor keys, delete, insert, and more). Checks input data** for valid entries and **displays error messages.**
Programs are easily **merged** with your own programs.
Easy to follow documentation shows how and where you can **modify the generated programs.**

- **Available now with IBM PC, PCjr, PCXT, and all true compatibles.**
- **Requires 128k RAM, one floppy disk drive, and PC DOS. Works with any 80 column display type.**

* Turbo PASCAL is a registered trademark of Boreland International, Ltd. IBM is a registered trademark of IBM corporation.

TO ORDER SEE YOUR LOCAL DEALER OR CALL (718) 728-2200

Only $125.00

(Includes shipping and handling)
(N.Y.S. Res. Add 8¼% sales tax)

Credit Card Orders call 1-800-824-7888. Operator 268
Alaska and Hawaii call 1-800-824-7919. Operator 268
DEALER INQUIRIES INVITED. SORRY, NO C.O.D.
Produced and Distributed by **The Software Bottling Co. of New York.**
29-14 23 Ave., New York City, N.Y. 11105

ITEM No. 3300

CIRCLE NO. 172 ON READER SERVICE CARD

PC BRAND™'s CRAFTSMAN™ TOOLS FOR C PROFESSIONALS

LIBRARIES: *Hundreds of Functions for Fast Programming*

C is a bare-bones language. It does not have built-in (machine dependent) functions for printing or floating point math or string manipulation. That's why it's so portable. That's also why libraries of pre-written functions are such big sellers: bullet-proof routines your application can effortlessly call to get the job done.

GREENLEAF FUNCTIONS

More than 200 functions in C and/or assembler source, and a 200 page manual with examples and demos.

32 DOS extensions: file and directory manipulation for DOS 1.1 and 2.0.

23 Screen Functions: Select mode, page, monochrome or color, palette; cursor shape, positioning; clearing and scrolling; character reading and writing with attribute and color control; pixel get and put; read light pen.

60 String Functions: Manipulation of strings including center and justify; efficient list operations which add, delete, and sort pointers to strings for top speed.

50 Graphics Functions: Primitives to access all graphics; typeface, formatting, and forms control for IBM Graphics Printer.

Plus keyboard status and function key assignment, time and date algorithms . . .we could go on!

Product Code: S0770 # Our Price:
List Price: **$175.00** **$140.00**

GREENLEAF COMMUNICATIONS

Want your application to communicate with other users or remote date bases? Now you can build asynchronous communications right into your C programs!

Over 60 functions set up an interrupt driven scheme with separate transmit and receive ring buffers (characters are simultaneously loaded at one end and transmitted from the other, or vice versa) for an arbitrary number of ports. Interrupt control means you can download a record, then halt the incoming stream to file it, display it, let the user tamper with it, send it back up line. It all happens within the context of *your* program, using your user commands, and does away with the sidestep to the separate communications software (and its semantics) you had to use until now.

The Greenleaf Comm Library supports ASCII or binary, any parity, any word length, 8250 UARTs, all four Lattice C memory models, Hayes 300, 1200, 1200B and other modems.

Its 80-page manual has examples of each function, discusses asynchronous communications, and both the library and demo programs come with source (a mix of C and assembler)!

Product Code: S0750 # Our Price:
List Price: **$160.00** **$130.00**

LATTICE C-FOOD SMORGASBORD

Decimal Arithmetic: Trigonometric, logarithmic functions, powers, conversion to strings, BCD operations for numbers up to 16 significant digits.

Level 0 I/O Functions: Direct operations for screen, keyboard, printer, and asynch port with no dependence on higher level I/O will minimize memory usage and maximize speed.

IBM PC BIOS Interface Access: Gets basic I/O services in ROM BIOS not available from the operating system to get and set video mode, cursor position, color and screen attributes, keyboard shift, scrolling, printer channel, port status.

Terminal Independence Package lets you move programs to computers with other types of terminals.

Product Code: S0200 # Our Price:
List Price: **$150.00** **$115.00**

Quite a treasure. So cost effective that after using only a couple of functions you'll be saving a bundle compared to writing your own. (It's true; how much do you cost per day?). So why not go for the whole bundle!

HALO

A Spectacular Graphics Extension to Lattice C

Halo™ will astound you. It provides a complete library of graphic functions which can be linked with your Lattice programs to create full-color charts, graphs, simulations, even animation.

Over 100 commands are at your disposal, including plot, line, arc, box, circle, plus single commands to produce bar graphs and pie charts. Pattern-fill and dithering commands give your graphics impressive texture and color mixes, rubber-banding draws shapes for interactive users, area moves produce animation, fill and flood commands paint areas. The newest version allows you to define your own world coordinate scheme, divide the screen into "viewports" (windows), and scale graphic figures automatically.

It's a long list of capabilities which make for an extraordinarily powerful product. In fact, Halo is so good that manufacturers of graphics boards and systems are adopting it as a standard graphics language. So it can bridge your application to other systems. CAD-CAM developers, especially, have embraced its device-independent approach for maximal portability. Halo offers a dazzling demonstration that function library architecture will tremendously enhance your firepower.

You'll need an IBM monochrome or color graphics board for our standard version, but other versions now support ten boards and their equivalents. Halo is sold in a one board, one language configuration (special pricing for multiples), but each version now comes with a multitude of I/O drivers for mice and printers.

Tip: Ask us to throw in Dr. Halo for an extra $95. It's a "paint" program written with Halo, far surpasses other pretenders, and will open up realms of creativity. Brilliant beyond belief.

Product Code: S0300 Our Price:
List Price: **$200.00** **$125.00**

PMATE

The Programmer's Word Processor

Pmate™ was designed for programmers. We'll wager that you cannot find a programmer who has discovered Pmate and moved on to something else.

Pmate is a full screen editor with ten auxiliary buffers for squirreling away pieces of text until needed. It uses single key commands to move the cursor, or text, or insert or delete, or rescue several thousand characters of deleted text.

It has a format mode for tab setting or wraparound and shaping when it's time to write documentation. Pmate lets you assign chains of commands or strings of text to single keys: a keystroke could set up the entire shell of a new C function, for example.

Pmate has variables, if-then statements, loops. It calculates, and converts decimal to hex to binary and back. You can write compact programs (called "macros") to delete comments, for example, or check syntax, or process long sequences of commands. Macros can alphabetize lists, do row and column math, perform a series of operations on multiple files, even summon other macros.

Put another way, Pmate is a text editor with its own built-in interpretive language. A language you can use to completely customize this text editor to your fancy. Possibly the most artful, ingenious program you have ever seen.

Product Code: S0600 # Our Price:
List Price: **$225.00** **$175.00**

BASIC_C

Use Your Knowledge of BASIC to Learn C

If you're getting the message that switching from BASIC to C would be prudent, you're about to discover that it's back to basics of a different sort. BASIC is fat with hidden functions that stripped down C just doesn't have.

Gone are all those handy string manipulators like LEFT$, MID$, STRING$, etc. (although our library offerings add them back). In C, when you reach for even simple invocations like INPUT or PRINT A$,X% — well, sorry to disappoint, but underlying such expressions in BASIC are bulging macros which C cannot have if it is to keep its slim profile.

But now comes BASIC_C and all your old favorites are back. Someone has written the full set of C functions to mimic BASIC's vocabulary, from ABS to WRITE. Over 80 routines to open and close files, "field" file buffers, convert their contents from and to strings (the CV? and MK? series), peek and poke, print using, clear screen, "instr", on error goto. . . they're all there. Some have reworked names and syntax to suit C, but all are written as one-to-one functional equivalents to the familiar features of BASIC. And they are documented one to a page in alphabetical sequence like the Microsoft manual for added familiarity.

So with BASIC_C, when you're thinking INPUT, go ahead. Use it. Or LPRINT or LOCATE or INKEY. But without BASIC_C, you will find that every line of code plunges you back in the C texts to figure out how to write it. Someday you'll want to, but for now, BASIC_C will start you programming quickly at the statement level so that you can concentrate on C's larger concepts.

There's a bonus: an unusually well-written manual with a first rate chapter comparing how BASIC and C go about their tasks. Without question, BASIC_C will ease your transition to C.

Product Code: S0350 # Our Price:
List Price: **$175.00** **$145.00**

LATTICE WINDOW

All Your Applications Could Have Windows!

Windows are no gimmick. *Ask* any user of a windowed product.

But how do you add this technique to your applications without disappearing for several months of R&D?

With Lattice Window,™ that's how. One of those rare programming tools which will change the way you think of program design. Here's how:

Lattice Window takes over all screen management. It is an extensive set of object code functions which you merely call from your C program.

Think of a window as a screen of flexible size. You can tell Lattice Window to open and close many such virtual screens. Up to 255 at a time, each from 1x1 to 255x255 bytes. Then tell "Window" to display any portion of these virtual screens on the physical screen — as many as fit. Tell "Window" to place them wherever you want, overlapping and overlaying at will.

Windows no longer needed may be closed. Any background area overlaid earlier (which could be corners of several windows) will pop back to the screen. Think for a moment what a programming job that technique represents.

To your program, the entered window is the *entire* screen — all row and column references are relative to the window no matter its absolute position in the screen. All scrolling occurs only within the active window. The cursor will not leave its boundaries until your program says to. Any screen window may be entered for display, data entry, whatever. *Any* virtual screen — displayed or not — may be read from or written to by your program.

- You can move a window on the screen.
- You can grow it to display more of the underlying virtual screen. Or shrink it to show less.
- You can control screen attributes (color, blinking, inverse video, etc.) of any window.
- You can direct output to either the monochrome or color board.

It's a formidable product which will add incomparable flair to your next application!

Product Code: S0800 # Our Price:
List Price: **$295.00** **$235.00**

FAST-C

This Editor Finds Compile Errors

Here's how to speed up the glacial crawl of editing your program file, running the compiler, noting errors, counting lines to find them, reloading the editor, and around again:

Re-direct Lattice C's error messages to FAST-C (via pipe or file). FAST-C puts errors and program together on the screen and gets you out of the line counting profession. It shows each error message in turn, highlights the program line which caused it, and displays the ten lines above it. FAST-C is an editor, so you can fix the error on the spot, then move on to the next, or access your entire program, add new code, etc.

You also get a library of handy debugging functions which display values, let you modify them, show contents beginning at a specified address in both hex and characters, and signal whereabouts in the program. And a multi-file scanner which can find or search and replace, using wildcards, up to 100 files at one go.

Product Code: S0250# Our Price:
List Price: **$129.95** **$105.00**

UNBEATABLE PRICES, TOP QUALITY, OUR DIME!

BTRIEVE

Is a Pro Like You Still Doing the Filing?

If your programming still gets anywhere near the files, here's our guarantee: Nothing will increase your productivity faster than handing the filing job to a sophisticated file manager.

Btrieve™ is the best we have seen. It takes complete charge of all file indexing, reading, writing, insertion and deletion. It builds 22 commands right into the language you use in the form of functions you call to tell Btrieve what to do. The commands create, open, and close files; delete and insert records, recapturing vacated space; find records which exactly or most nearly match keys; walk files by ascending or descending key.

Btrieve's foundation is a balanced-tree indexing scheme, conceded to be the fastest search technique devised (it will find any key in a million-plus item index in four or less accesses).

Btrieve comes with interfaces to C, Pascal, BASIC, and COBOL, and the manual gives you working sample programs which demonstrate every command in all four languages. The kind of presentation which led *PC World* to exclaim "for those of us who have endured poorly written and inadequate manuals, this one is a pleasure to read."

Btrieve has mainframe specifications! A single file may have up to 24 indexes. Segments of keys may be indexed. Each index can independently accept or block duplicate keys. A record length can be up to 4090 characters; an index length 255 characters. A file may be 4 billion bytes. It can even extend a file across two drives — even two hard disks!

With Btrieve you are freed to think logically; the physical file is no longer of concern. Gone for good is all that time-wasting dickering with intricate file referencing schemes and sorting algorithms. Thinking shifts to a higher plane.

Product Code: S0650 Our Price: **$199.00**
List Price: **$245.00**

PANEL

You've Hand-Coded Your Last Data Entry Screen

Designing custom screens is intricate, time-consuming, and costly. It can make you the loser in competitive bidding. It can add weeks, even months to bringing your product to market.

But not when you use Panel™. Put Panel to work and you hire a superprogrammer for the minimum wage. Telling Panel your screen design is like using a word processor. You can add, move, copy, delete, and reshape fields with single key commands. The result? Finished C source code with field descriptors, color and highlighting, input editing by type of field, help keys, and warning messages.

Panel can also create a terminal selection program customized for your application, and gives you a utility to quickly test your finished screens. It supports user-written input verification code. It even includes a multi-key data file maintenance program which interacts with the screen you design. All the tools you need to generate code for the trickier aspects of your application.

Panel routines are powerful. Unlike so many programs which make error correction difficult once a field is departed, Panel gives the user full field-to-field movement for editing, and overtype or insert/delete within fields.

A truly superior productivity tool every developer should have.

Product Code: S0400 #* Our Price: **$235.00**
List Price: **$295.00**

*except "Tailor"

Unix TM Bell Laboratories / Lattice C, C-Food Smorgasbord, and Lattice Window TM Lattice Inc. / MS TM Microsoft Inc. / Halo & Dr Halo TM Media Cybernetics / IBM TM International Business Machines / Panel TM Roundhill Computer Systems Ltd. / Plink86, Pmate, and Pfix86 TM Phoenix Software / Btrieve TM Softcraft Inc. / Float87 TM Microfloat

LATTICE C

The Preeminent 16-bit C Compiler

C's structured approach encourages development of tight, fail-safe functions which can be counted on to return reliable results every time. Local variables unknown outside of functions to safeguard against collision. Extremely powerful nested expressions which produce elegant, concise code.

Lattice C™ is the unparalleled choice for program development. *Byte* said "the Lattice C compiler produces remarkable code. . .outstanding in terms of both execution speed and code compactness". After reviewing nine compilers for the PC, the *PC Tech Journal* unequivocally declared Lattice C "best for software development . . . it compiles fast and produces fast programs".

Lattice C is a full implementation of Kernighan and Ritchie, not a subset, plus extra features such as nested comments, and 39-character variable names.

Lattice C runs on virtually any computer using an 8086 or 8088 microprocessor. Create your source files with any word processor or text editor like our Pmate or ES/P for C and Lattice C will compile them into Intel 8086 object module format for linking with other modules by DOS' Link or our Plink86.

Lattice C offers a choice of four memory models which allow the program designer to choose the right combination of efficiency and size for an application: a range between 64K and RAM capacity for program and data.

The compiler comes with a library of I/O routines which implement under MS™DOS most of the Unix-compatible standards described by Kernighan & Ritchie; a fulsome set of transcendental and Unix math functions K&R didn't think to mention; and some of Unix's most useful options such as Fork, to pull another program into memory in parallel, branch to it, and return. Lattice C will also automatically sense and use the 8087 chip.

The documentation, which *Byte* says "sets such a high standard of excellence that others don't even come close," covers the interface to assembly language and machine dependencies. Needs 128K.

Product Code: S0100 # Our Price: **$295.00**
List Price: **$500.00**

PLINK86

Overlay Linkage to Expand Your Art of the Possible

Software is becoming ever more sophisticated, which means more complex programs requiring large chunks of memory. But if you use extra memory, you count on users to have expanded RAM, and forego sales to those who do not.

Plink86™ is the answer. It shoe-horns large programs into small memory. First, Plink86 acts as an alternative to DOS' Link. C encourages design of separately compiled object modules in the Microsoft relocatable format. Plink86 pulls modules together into single compiled programs. But Plink86's overlay power is what has gained it a reputation as a miracle worker. It binds into the compiled program its overlay manager which knows how to swap modules of your large linked program between disk and memory, so that each can temporarily occupy the same memory space.

Unlike other linkers, the overlay manager acts on its own, needing no calls from the source program. Instead, Plink86's straightforward overlay description language allows you to describe your overlay structure in one place in your program — a structure permitting up to 4,095 overlays stacked 32 deep. No recompiling to re-arrange the structure!

Plink86 can even sub-divide its linked output into multiple files for programs which must span more than one disk. And it produces a symbol map for debugging with Pfix86 Plus.

But most of all it sets you free to write the comprehensive code today's users have come to expect without sacrifices to memory constraints.

Product Code: S0500 # Our Price: **$315.00**
List Price: **$395.00**

PFIX86

Advanced Dynamic and Symbolic Debuggers

Debugging programs without special tools is like fixing an automobile without lifting the hood. Pfix86™ lets you see inside your program while it is running: multiple windows show program code and data, breakpoint settings, and current register and stack contents simultaneously. You can make changes by moving the cursor into a window and typing: code in the program window; bytes, words, addresses, and strings in the data window. It has an in-line assembler, so you can enter program modifications in assembler at run time.

Pfix86 Plus is an enhanced version for use with modules linked by Plink86, even those with overlays. It retains the program "symbols" otherwise lost during compiling — the names you gave to variables, functions, etc. in your source code — so you don't have to deal with inscrutable hex addresses.

Both versions have dynamic trace and breakpoint setting facilities. Breakpoints appear in both the code and breakpoint windows. You can then disable them without removal, activate them only upon their nth encounter, halt them when a condition is met, or enable or disable another breakpoint.

Code	List Price:	Our Price:
Pfix86 S0550 #	**$195.00**	**$155.00**
" Plus S0555 #	**$395.00**	**$315.00**

ES/P for C

The Next Best Thing to a C Interpreter

ES/P for C is a language dedicated editor. It *knows* C. Press ALT and a companion key and ES/P for C sets up for you a complete framework of a C structure, whether if-then-else, do-while, switches, loops — even the outer frameworks for "main" and entire functions.

Inside these structures, ES/P for C then outlines the components to be filled in: declarations, statements, etc. And when you go to fill in, say, a declaration segment, ES/P for C prompts for what's needed, shows menus of options — e.g., "int", "char", "float" — and fills in the semi-colons and curly braces for you.

To say that it will save countless keystrokes is the most trivial benefit. ES/P for C is really a powerful outline processor. It lets you erect the superstructure of an entire program in minutes, with all structures properly nested, code neatly indented, and reserved words in place. Then prompts to make sure you don't forget to fill in all the spaces between.

Now that ES/P for C has looked after syntax and punctuation, watch compile time errors evaporate. And we haven't even mentioned that ES/P for C can operate on four files at once in separate windows. Also available for Pascal.

Product Code: S0450 # Our Price: **$199.00**
List Price: **$245.00**

TERMS AND CONDITIONS OF SALE

Licenses: Each price is for a license to use a product on a single computer and does not constitute its ownership. Products coded "#" may be used to create programs for distribution without royalty payments or additional licenses, provided said programs do not substantially duplicate the products themselves.

Compatibility: PC BRAND's standard products are designed to operate with the IBM PC or PC/XT under PC-DOS and require no more than 64K of RAM unless indicated.

Returns: Products returned will be accepted for refund or credit only by prior authorization subject to a re-stocking charge. Software diskettes are delivered in sealed envelopes and are unreturnable if seal is broken.

Payment: MasterCard & Visa (no surcharge), wired funds, checks in advance, and COD for cash or certified check. Purchase orders accepted from corporations and institutions at our discretion; 2% per month added to balances unpaid after 30 days.

Shipping & Handling: U.S.: UPS Surface: 1st product $6, each add'l $2.50. UPS 2nd Day Air: 1st product $7.50, each add'l $3.50. UPS Next Day Air or Federal Express: 1st product $18, each add'l $4. Non U.S.: $15 per order for export/import forms; variable shipping charge.

Prices, terms, and specifications subject to change without notice.

We're waiting for your order at . . .

800-PC BRAND

That's (800) 722-7263. In NY State call (212) 410-4001.
PC Brand, P.O. Box 474, New York, N.Y. 10028

PC BRAND and Craftsman are trademarks of PC BRAND.

© 1984 PC BRAND

CIRCLE NO. 170 ON READER SERVICE CARD

Entymological Explorations

Bugs come in all shapes and sizes. Choosing the right debugger demands careful consideration.

STEVEN ARMBRUST and TED FORGERON

Back when IBM first introduced the PC, life as a software developer was simple. There were few programming languages to choose from, and even fewer debuggers. In fact, only one debugger existed then—IBM DEBUG, developed by Microsoft and included at no extra cost with PC-DOS.

Now, nearly 20 debuggers are on the market, with more becoming available each day. Some are relatively cheap; some cost thousands of dollars. All claim to do a better job than DEBUG.

CATEGORIZING DEBUGGERS

In an attempt to clear up the confusion associated with the sheer number of new debuggers now on the market, we have defined five classes of general-purpose debuggers for the IBM PC. Some overlap exists between classes—debuggers in one category that have isolated features attributed to another class. And, no single debugger contains all the features listed for its class. But it's easy to see that most debuggers fit into one of the categories listed.

The debuggers that do not fit into any of the general classes are usually special-purpose (or environment-specific) debuggers. For example, c-windows from c-systems is a powerful debugger that works only with the c-systems C compiler. Windows Probe from Atron is powerful product with the specific purpose of debugging programs that use Microsoft Windows. These debugging tools perform valuable functions, but they might not be general enough to satisfy all debugging needs.

Assembly Language Debuggers. The products in this class (IBM DEBUG is the best-known) are the least sophisticated of

Steven Armbrust is a senior documentation engineer and Ted Forgeron is vice president of systems software engineering at Multisoft Corporation.

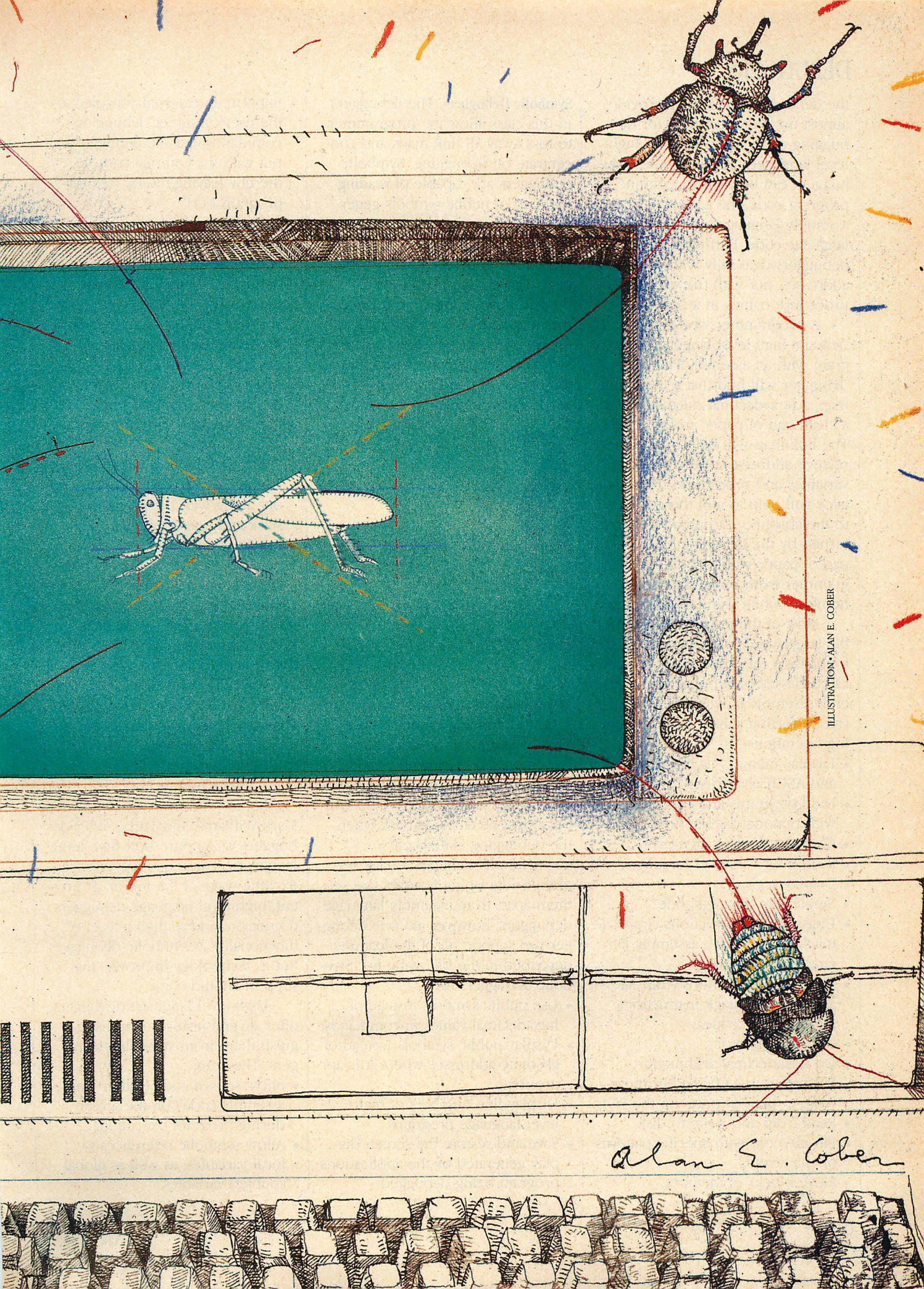


ILLUSTRATION • ALAN E. COBER
Alan E. Cober

the debugging tools; they provide almost no additional help for debugging programs written in high-level languages. Although these debuggers can be used to examine program code, the code will be in assembly language, not high-level language code. Furthermore, these debuggers deal only with absolute addresses, not with the variable and procedure names in a program.

A programmer who attempts to debug a high-level language program with an assembly language debugger will find that a fresh link map, a hexadecimal calculator, and a clean pad of paper are necessary. The link map will help to find the relative addresses of the program's variables and procedures, the calculator will help to add these offsets to the absolute starting address returned by the debugger, and the pad of paper will keep the programmer from forgetting these numbers while using the debugger.

Most of the features of assembly language debuggers provide the foundation for other, more sophisticated classes of debuggers. In general, assembly language debuggers can perform a subset of the following operations:

- Display memory as hexadecimal and ASCII characters.
- Load programs and execute them with optional breakpoints.
- Change values in memory.
- Search for values in memory.
- Display registers.
- Single-step through code.
- Unassemble instructions (translate machine code into assembly language instructions).
- Assemble instructions (translate assembly language instructions into machine code).
- Compare memory.
- Do hexadecimal arithmetic.
- Perform port I/O (read from or write to the I/O ports on the PC).
- Read from and write to disk.
- Fill memory with specific patterns of characters.
- Move blocks of memory.

Symbolic Debuggers. The debuggers in this class allow the programmer to toss away all link maps and concentrate on debugging. Symbolic debuggers are capable of reading the map of public symbols generated by the linker, so that the actual names of public procedures and variables can be used while debugging. There is no need to get bogged down converting relative memory addresses to absolute addresses. One inconvenience with symbolic debuggers is that although the names of public symbols can be used while debugging, the names

Symbolic debuggers allow the programmer to toss away all link maps and concentrate on debugging.

of procedures and variables that are local to a module cannot be used. This problem can be skirted by temporarily declaring all symbols in a module public. This will make the code larger and slower, so the symbols must be changed back when the debugging is finished.

Symbolic debuggers have several distinguishing features that set them apart from assembly language debuggers; however, no one debugger can support all of the features described in the following list. Symbolic debuggers can:

- Use public symbols instead of hexadecimal values in commands.
- Display public symbols instead of absolute addresses where it is appropriate.
- Display line numbers of high-level language programs.
- Save and restore the screen display generated by the applications program being debugged.
- Support an external console (so the user can enter debugging commands and see debugger output with the external console, thereby leaving the PC free for program I/O).
- Support the debugging of overlaid code. (Debugging overlaid code with an assembly language debugger is difficult because there is no way of knowing the absolute address of an overlaid procedure until that procedure has been loaded.)
- Allow the user to view the source or listing file while debugging.
- Provide on-line help for debugging commands.
- Provide multiple-window display so the user can see parts of memory along with the program's stack and unassembled code.
- Provide a macro facility that can be used for combining multiple debugging commands.

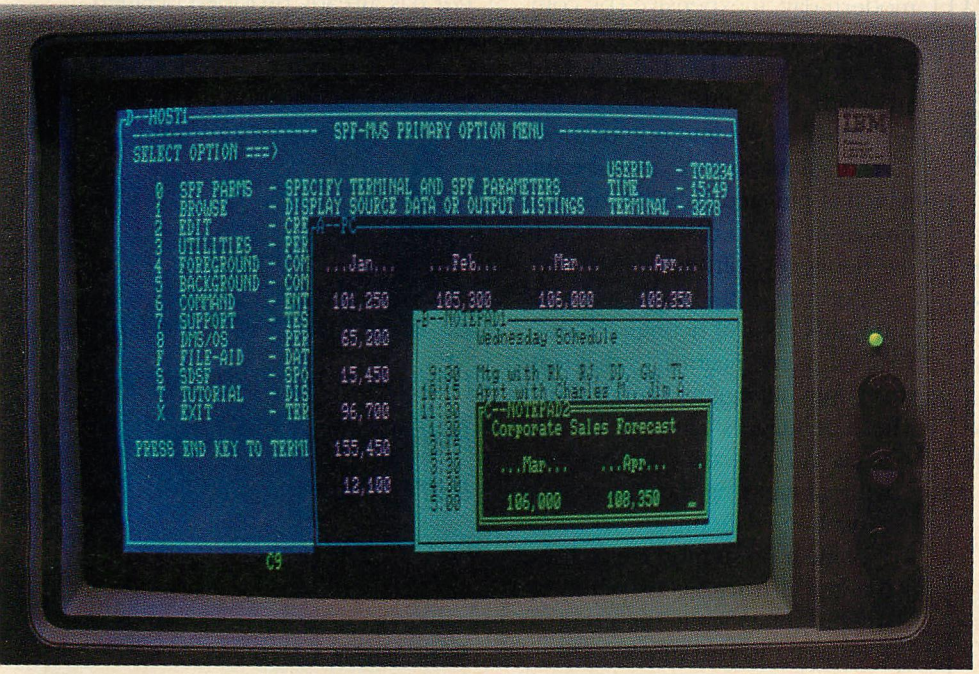
High-level Language Debuggers. With all the features that symbolic debuggers provide, they still require the user to look at machine code and assembly language instructions on the screen when debugging. High-level language debuggers are for programmers who do not want to deal with debugging at the machine instruction level.

Some vendors, such as C-Ware, Mark Williams, and Turbo, offer debuggers to support their high-level languages. These debuggers are an exciting wave of the future. At present, high-level language debuggers do not provide as high a level of functionality as symbolic debuggers, but as technology improves, that support should come.

High-level language debuggers offer several features that distinguish them from symbolic debuggers. They can:

- Show source code (rather than assembly code) on the screen during program execution.
- Allow symbolic references to local variables, as well as global (public) variables.

Compared to this, other 3278/79 emulators aren't much to look at.



Look closely.

This isn't your everyday 3278/79 emulator. Ours gives you much more to work with. Namely, a host session, a PC DOS session and two notepads. All on the same screen. At the same time.

We call it the CXI 3278/79 PLUS PC connection.

Fortunately, it's easier to use than it is to say.

There's no toggling back and forth between sessions. No shuffling floppies to move information.

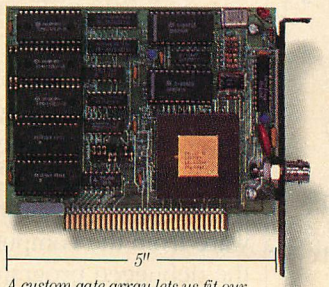
The 3278/79 PLUS turns an IBM® PC, XT or compatible into a 3278 or 3279 terminal. Plus a lot more. So now everyone can have the most current data at their fingertips. In a format they all can use.

It comes in two versions. Either a coaxial or modem connection. And both versions provide fast, easy file transfers between a PC and a CMS or TSO host. There's even a batch file generator that serves up multiple files with just a few keystrokes.

And for your colleagues overseas, international keyboard mapping comes standard.

But perhaps the biggest advantage of our emulator board is its small size. It's just five inches long. (Or short, depending how you look at it.) Which means it fits conveniently into a PC's short expansion slot. Leaving the long slots for the rest of the world.

For those who need additional host sessions, we also offer the CXI 3270 PC connection. It displays five host applications, a PC DOS program and two notepads—simultaneously.



A custom gate array lets us fit our 3278/79 emulator on a 5" board and still offer more capability than all the rest.

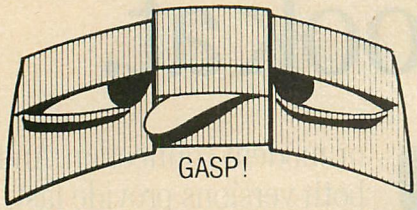
All our CONNECTWARE™ products are available on a 30-day free trial basis. So for a closer look, call 800/221-6402. In California, call 415/424-0700. Or write CXI, Inc., 3606 West Bayshore Road, Palo Alto, CA 94303. Telex 821945.

Because compared to our 3278/79 emulator, there is no comparison.

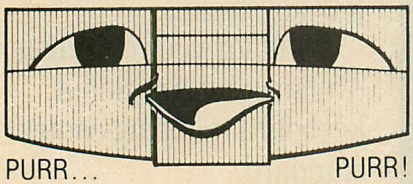
CXI

CONNECTWARE is a trademark of CXI, Inc. IBM is a registered trademark of International Business Machines Corp. © 1984, CXI, Inc.

It's too late when you can see that your disc drive has problems...



ReadiScope™
is your eyes and ears *inside* your disc drives.



***ReadiScope* is a comprehensive diagnostic program that analyzes the current status of a diskette drive. It graphically displays the alignment pattern so that adjustments to head, spindle hub alignment, and rotational speed can be made in minutes without special equipment.**

- **Floppy drives, single or double sided drives, can be tested while installed under normal operating conditions**
- **Ideal for use by: PC Clubs; Users with Critical Data; Repair Shops; Multi-PC Users; Retail Stores**

Requires 48K IBM PC with one operating drive. Uses monochrome or graphics display. $295. including special diagnostic diskette.

Visa, Mastercard or MO. Add $3. for shipping. *MI residents add sales tax.*

Call 616-327-9172 or send your order now to:

ReadiWare Systems, Inc.

P.O. Box 515, Portage, MI 49081

CIRCLE NO. 220 ON READER SERVICE CARD

DEBUGGERS

- Set breakpoints at lines of source code, rather than at machine-level addresses.
- Single-step through lines of source code. This allows the programmer to think in terms of lines of source code instead of being forced to step through assembly language instructions.

Hardware-assisted Debuggers. Hardware-assisted debuggers are the modern-day, inexpensive (by comparison) replacements for in-circuit emulators (discussed below). They are made up of three parts: a circuit board that plugs into one of the expansion slots on a PC, a probe into which is plugged an 8088 microprocessor, and a diskette containing the debugger software.

Because of the additional hardware, this class of debugger can perform some neat tricks that software-only debuggers cannot touch. These debuggers can:

- Support hardware breakpoints without affecting the speed of the executing program.
- Provide a program trace (a list of the last instructions executed by the program) while the program is running in real time.
- Provide protected memory for the debugger software.
- Recover from program crashes without rebooting the machine and clearing memory.
- Analyze a program to determine where the performance bottlenecks are hiding.

In-circuit Emulators. An in-circuit emulator (ICE) has essentially the same features as a high-end hardware-assisted debugger, but at a much higher price. ICE units isolate the debugger hardware and software from the computer that runs the debugged program. This ensures that the debugger will not become corrupted by the same bug that caused the tested program to fail in the first place. And, conversely, they can ensure that anomalies in the debugger do not affect the program being debugged.

The problem with ICE units is that they are expensive. Intel's ICE-88 prices start at about $7,500, and to use one, an Intel development system is necessary.

THE RIGHT DEBUGGER

The rest of this article offers capsule summaries of most of the debuggers in each class. Table 1 compares their features. *PC Tech Journal* has already provided detailed reviews of some of these debuggers in previous issues and will review more debuggers in future issues.

An in-circuit emulator (ICE) has essentially the same features as a high-end hardware-assisted debugger, but at a much higher price.

ASSEMBLY-LANGUAGE DEBUGGERS

DEBUG (IBM). DEBUG is the granddaddy of all PC debuggers. It first became available with the introduction of the PC in 1981. Although distributed by IBM, DEBUG (like DOS) was developed by Microsoft Corporation. DEBUG is the least powerful but most often used of the debuggers in this survey.

DEBUG's comparative lack of power stems from the fact that it is the base upon which all other debuggers are built. This situation is much like that of second-generation spreadsheets, such as Lotus 1-2-3, which contain the same core of features as their predecessor—VisiCalc—and which use this core as a base upon which to build more powerful and exciting features.

Despite DEBUG's lack of gusto, it is by far the most popular debug-

ger for the IBM PC. Its popularity has nothing to do with the program itself and everything to do with the price. It is free with the purchase of PC-DOS. And everyone has PC-DOS.

Trace86 (Morgan Computing). This debugger was reviewed in-depth in the May 1984 issue of *PC Tech Journal* ("Two New Ways to Drive the Bugs Away," Ray Duncan, p. 110). Trace86 is not a bad value among assembly language debuggers. At $125, it is a pretty good bargain.

Trace86 is organized around separate "command" and "trace" screens. The command screen lets the user enter file- and data-handling commands. The trace screen allows him to see program code, registers, stack, and memory. These screens are clean and well thought out. The command set is extensive and easy to use.

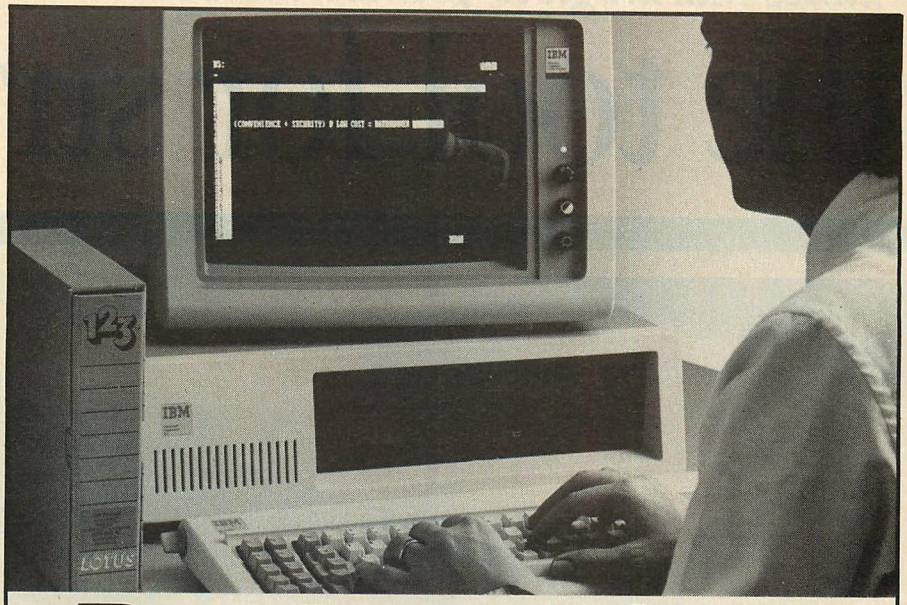
One excellent feature is the automatic trace, which appears on the screen at 1/10,000th the speed of normal execution and lets the user see what his code is doing at a comfortable viewing speed.

For novice assembly language users, Trace86 is a must. It gives them a ringside seat from which to watch their instructions dance.

87DEBUG (MicroWay, Inc.). As might be guessed by the name, 87DEBUG offers a lot of support for the 8087 numeric coprocessor. MicroWay, Inc. (formerly MicroWare) is well-known as the mail-order source for the 8087 and supporting products. Its experience in the 8087 field shows in this debugger.

One of the most powerful features of 87DEBUG is its ability to show real numbers in memory (and let the user enter them), using the 8087 number formats. In addition, the user can display or change all of the 8087 registers and unassemble 8087 instructions.

This debugger also includes many of the more typical commands of other assembly language debuggers. But its true strength lies in its handling of the 8087.



Run Lotus from your hard-disk

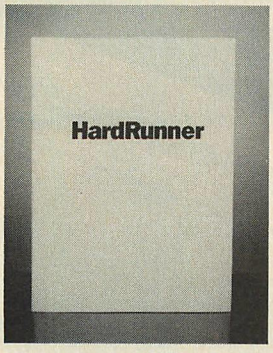
HardRunner™ allows you to run Lotus™ 1-2-3™ and Symphony™ from your hard-disk without putting your Lotus System Disk in Drive A.

HardRunner is a self-installing utility program that allows you to run Lotus 1-2-3 (version 1A) and Symphony (version 1.0) right off your hard-disk! HardRunner lets you use your hard-disk system the way it was designed to be used!

HardRunner makes absolutely no alterations to your Lotus or Symphony programs. Quit worrying about losing or destroying your System Program Diskettes. Avoid the hassle of placing a Diskette in Drive A in order to run a program that already resides on your hard disk. So order HardRunner today and put your System Program Diskette safely away.

HardRunner works with the IBM® PC, XT and AT, true compatibles, and the TI™ Professional. PC or MS DOS version 2.0 or higher is required.

So run with the Best! Run with HardRunner! 24 hour Toll Free **1-800-328-2828.** In Utah call 1-800-662-2500.



Please send me your new HardRunner hard-disk utility. **$29.95**
($29.95 plus $5.00 shipping and handling)
Utah residents add 5¾ % sales tax.

Name _____

Address _____

City _____

State _____ Zip _____

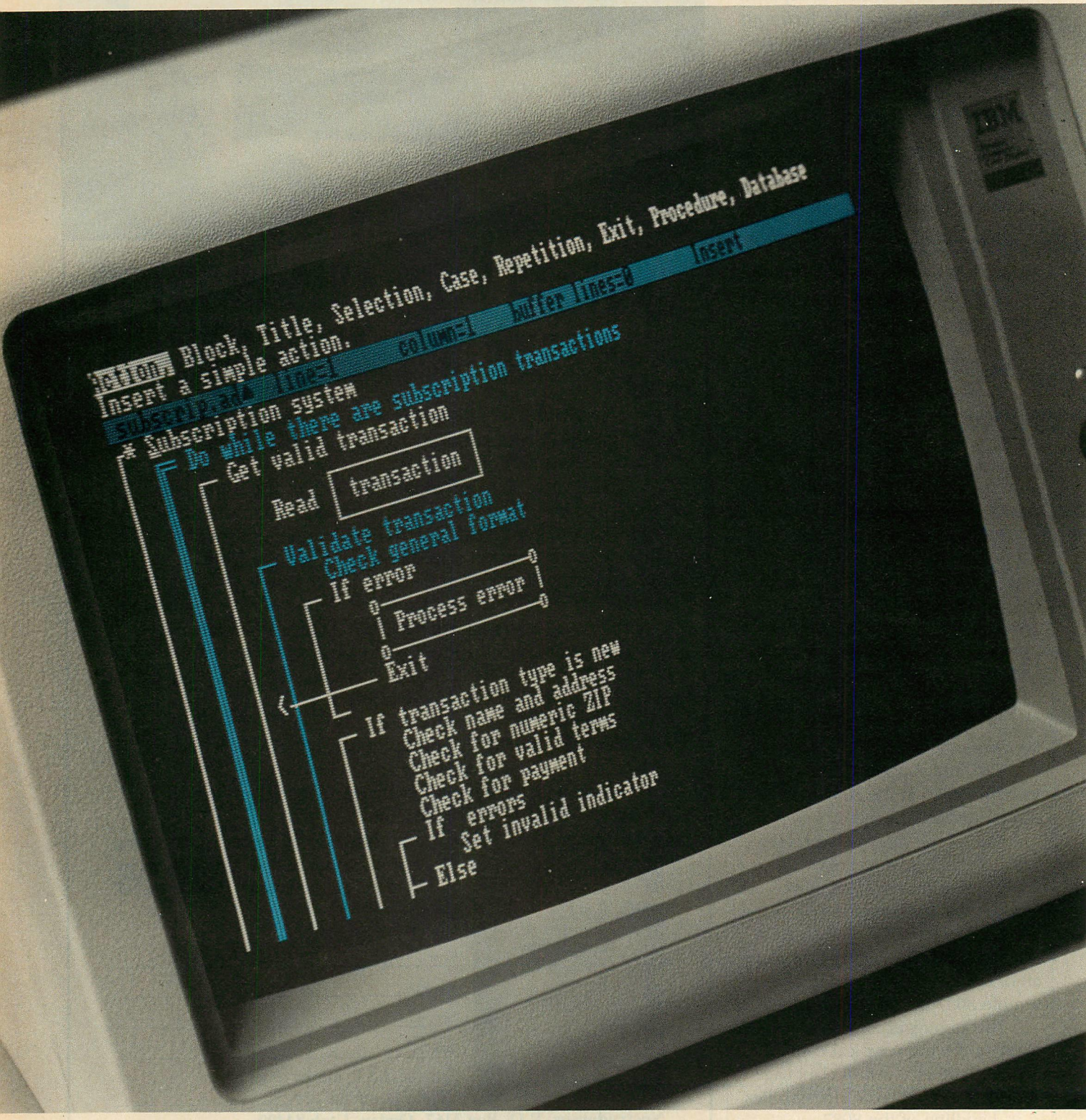
Enclose check, money order or VISA/Mastercharge #_____

Nostradamus, P.O. Box 3167, Ogden, Utah 84409

CIRCLE NO. 189 ON READER SERVICE CARD

James Martin gives you the method... now DDI gives you...

the tool for structured



IBM is a trademark of International Business Machines, Inc.
FOCUS is a trademark of Information Builders Inc.
RAMIS is a trademark of Mathematica Products Group.
NOMAD is a trademark of D&B Computing Services.
MANTIS is a trademark of Cincom Systems.
IDEAL is a trademark of Applied Data Research.
NATURAL is a trademark of Software A G of N. A.
ADS/O is a trademark of Cullinet Software.

programming.

While doing research for their recent book,* James Martin and Carma McClure reviewed seventeen diagramming techniques and came to one overwhelming conclusion:

Action diagrams are the simplest and best method of representing structured programs.

Action diagrams combine graphic and narrative notations in a rigorous but easy-to-understand technique. The method is applicable to any size program. In almost any language.

When used to sketch out program logic, action diagrams encourage correct structured thinking. Logic errors become more apparent. Communication improves among programmers, analysts, and end users. And top-down design is enhanced, because action diagrams handle any level of logic, from systems overview to detailed program code.

* *Diagramming Techniques for Analysts and Programmers* Prentice-Hall, 1984

Fast, full-screen editing with ACTION DIAGRAMMER™ and an IBM PC.

Working closely with James Martin, DDI has developed an action diagram editor for the IBM Personal Computer and 100% compatibles. The Action Diagrammer™ editor lets you create and update action diagrams right on the screen. You draw brackets with a single keystroke. Manipulate text with all the power of a visual editor. And expand or contract to focus on any level of detail you choose.

The net result: faster application development

With Action Diagrammer you can develop designs and programs faster, and with fewer errors. Maintenance is easier too, because Action Diagrammer enforces logic structure and provides excellent documentation.

The price is easy too – only $495

The Action Diagrammer software package sells for $495 and comes with a complete user guide, which includes a thorough overview of the action diagramming method. No serious programmer or analyst with access to an IBM PC or compatible should be without it.

Even more features

Represents logic hierarchy with nested brackets for all constructs such as sequence, selection, case, and repetition. Can also represent database actions and subprocedures

Automatically supplies control structure syntax in English, COBOL, PL/I, FORTRAN, C, Pascal, and many 4th generation languages including FOCUS, RAMIS, NOMAD, MANTIS, IDEAL, NATURAL, and ADS/O

Offers one-stroke commands and user programmable function keys

Shifts mainframe software development to PC's

Allows color coding of diagram sections through user control of text and bracket colors (for users who have a color monitor)

Includes ample help messages and other on-line documentation

Produces hard copy of action diagrams on any IBM PC-compatible printer. Graphic output on IBM graphics printer or HP7470A plotter

```
SUBSCRIPTION_SYSTEM: PROCEDURE OPTIONS (MAIN);
   /*
      SUBSCRIPTION SYSTEM TRANSACTION PROCESSING
   */

...* Variable Declarations */

   ON ENDFILE (DATA_FILE)
      EOF_DATA_FILE = YES;

   OPEN FILE (DATA_FILE);
   DO WHILE (^EOF_DATA_FILE);

      /* GET TRANSACTION */
      READ FILE (DATA_FILE) INTO (TRANSACTION);

      /* VALIDATE TRANSACTION */
      CALL CHECK_FORMAT (TRANSACTION, RC);
      IF RC = ERROR THEN
         CALL PROCESS_ERROR (TRANSACTION, RC, NO, NO, NO, NO);

      SELECT;
      WHEN (TRANSACTION.TYPE = 'NEW') DO;
         CANCELLATION = NO;
         CALL CHECK_NAME_ADDRESS (CUSTOMER, RC1);
         CALL CHECK_ZIP_CODE (ZIP_CODE, RC2);
         CALL CHECK_TERMS (TERMS, RC3);
         CALL CHECK_PAYMENT (PAYMENT, RC4);
         IF (RC1 | RC2 | RC3 | RC4) = ERROR THEN
            STATUS = ERROR;
         ELSE
            STATUS = NO_ERROR;

         END;
      WHEN (TRANSACTION.TYPE = 'RENEWAL') DO;
         CANCELLATION = NO;
         RC1 = NO_ERROR;
         RC2 = NO_ERROR;
         CALL CHECK_TERMS (TERMS,RC3);
         CALL CHECK_PAYMENT (PAYMENT, RC4);
         IF (RC3 | RC4) = ERROR THEN
            STATUS = ERROR;
         ELSE
            STATUS = NO_ERROR;

         END;
      WHEN (TRANSACTION.TYPE = 'CANCELLATION') DO;
         STATUS = NO_ERROR;
         CANCELLATION = NO;
         END;
         END;

      /* PROCESS VALID TRANSACTION */
      IF STATUS = NO_ERROR THEN
         SELECT;
         WHEN (TRANSACTION.TYPE = 'NEW')
            CALL NEW_SUBSCRIPTION (TRANSACTION);
         WHEN (TRANSACTION.TYPE = 'RENEWAL')
            CALL SUBSCRIPTION_RENEWAL (TRANSACTION);
         WHEN (TRANSACTION.TYPE = 'CANCELLATION')
            CALL SUBSCRIPTION_CANCELLATION (TRANSACTION);
            END;
```

Prove it yourself with our $25 demo diskette

If you're not already convinced, order our demo diskette. You can try out all the features and functions of Action Diagrammer with a step-by-step demonstration guide. (The demonstration diskette does limit your use to 50-line diagrams.) Your $25 can be credited to purchase of the full version of Action Diagrammer.

Two ways to order

You can order the demo diskette or the complete Action Diagrammer editor in either of two ways:

(1) CALL: 1-800-237-1977, EXT. 4101

Call our toll-free line between 8 am and 8 pm EST Monday thru Friday. VISA, MasterCard, and American Express credit card payments only. In Michigan call 800-447-3556, Ext. 4101.

(2) SEND CHECK OR PURCHASE ORDER

Send your check or company purchase order and specify quantity of Action Diagrammer or Demo Diskette. Add $2.50 shipping and handling for each item. Michigan residents add 4% sales tax.

Address to: Database Design, Inc., Order Processing Dept. A-101, P.O. Box 1000, 101 Union Street, Plymouth, MI 48170. Allow 4 weeks for delivery.

Database Design, Inc.

2020 Hogback Road, Ann Arbor, Michigan 48104

Software Tools for Martin Methodologies

ACTION DIAGRAMMER is a trademark of Database Design, Inc.

CIRCLE NO. 120 ON READER SERVICE CARD

TABLE 1: *Debugger Features*

	CLASS	8087 SUPPORT	SUPPORTS TWO MONITORS	MULTIPLE-WINDOW DISPLAY	VIEW ANOTHER FILE WHILE DEBUGGING	SUPPORTS REMOTE CONSOLE	SAVE AND RESTORE APPLICATIONS SCREENS	SEARCH MEMORY
IBM DEBUG 2.1	AL	Yes	No	No	No	No	No	Yes
TRACE86 1.09A	AL	Yes	No	No	No	No	No	Yes
PC-TEST 1.0	AL	No	No	Yes	Yes	No	Yes	No
87DEBUG 1.0	AL	Yes	No	No	No	No	No	Yes
PFIX86 1.01	AL	No	Yes	Yes	No	No	Yes	Yes
CODESMITH-86 1.8	SYM	No	Yes	Yes	No	No	Yes	Yes
MYLSTAR 2.0	SYM	Yes	No	No	No	No	No	Yes
SW PROBE 1.5	SYM	Yes	Yes	Yes	No	Yes	Yes	Yes
GENESCOPE 1.0	SYM	No	No	No	Yes	No	Yes	Yes
PFIX86-PLUS 1.02	SYM	No	Yes	Yes	No	No	Yes	Yes
SYMD 1.01	SYM	Yes	No	No	No	No	No	Yes
BUGSCREEN 1.0	SYM	No	No	Yes	Yes	No	Yes	No
PERISCOPE 1.0	SYM	No	Yes	No	No	No	Yes	Yes
SOFT-SCOPE 1.1	HLL	Yes	No	No	Yes	Yes	No	Yes
SW SOURCE PROBE 1.0	HLL	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SOURCE PROBE 1.0	HWA/HLL	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PDT-PC 2.0	HWA	Yes	No	No	Yes	No	Yes	Yes
PC PROBE 1.15	HWA	Yes	Yes	Yes	No	Yes	Yes	Yes
ICE-88 88A	ICE	Yes	Yes	No	No	Yes	N/A	Yes

[1]If program linked with Plink86
[2]Not real-time
[3]Shows source instead
[4]Reset switch
[5]Security key
[6]Boards

Pfix86 (Phoenix Computer Products Corp.). Pfix86 is a good choice for computers users who like windows. A recent entry in the debugger race, Pfix86 was released last summer by the same company that produced the Pmate program editor and the Plink86 overlay linker for IBM and Microsoft languages.

Pfix86 has the best windows of any debugger we surveyed. An especially nice feature is the stack window, which orients vertically on the screen. Pfix86 can be configured to show the stack growing either up or down. And, as an extra touch, the program even provides an arrow to point out the location of the current stack pointer (SP).

The major weakness of Pfix86 is its command syntax. It usually takes three keystrokes to initiate commands that most other debuggers can initiate with one key. This may seem minor, but after a long day, that two-keystroke overhead can get irritating and tiresome.

PC-Test (A.J.M. Associates). PC-Test is a friendly debugger. A.J.M. Associates claims that it did an extensive study to determine what programmers need when they debug code. As a result, it eliminated from PC-Test features such as unassembly of code to disk and block memory moves, and included features such as text browsing and test program screen maintenance. The company's attitude is that if the user needs features such as block memory move, DEBUG is available with DOS. PC-Test has very few commands and makes extensive use of the PC's function keys.

Two additional points are worth noting. First, PC-Test is fast. Written in assembly language, it really flies. Second, the source code for the debugger is supplied at no extra charge. The obvious benefit for those who are new to assembly language programming is that this assembly language source can serve as a coding example. And, the more experienced programmer can change the debugger to add customized features.

SYMBOLIC DEBUGGERS

CodeSmith-86 (Visual Age). Like Pfix86, CodeSmith-86 is window-oriented. Until recently, it was an assembly language debugger too.

However, the latest version of CodeSmith-86 has been enhanced to include support for symbols. Un-

COMPARE MEMORY	FILL MEMORY	ASSEMBLE TO MEMORY	MOVE MEMORY	DISPLAY SOURCE CODE DURING PROGRAM EXECUTION	DISPLAY SOURCE CODE LINE NUMBERS	HIGH-LEVEL LANGUAGE BREAKPOINTS	HIGH-LEVEL LANGUAGE SINGLE STEP	DISPLAY AND ACCEPT PUBLIC SYMBOLS	LOCAL SYMBOL SUPPORT
Yes	Yes	Yes	Yes	No	No	No	No	No	No
Yes	Yes	No	Yes	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
Yes	No	No	Yes	No	No	No	No	No	No
No	Yes	No	Yes	No	No	No	No	No	No
No	Yes	No	Yes	No	No	No	No	Yes	No
Yes	Yes	Yes	Yes	No	No	No	No	Yes	No
Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No
Yes	Yes	No	Yes	No	Yes	No	No	Yes	No
No	Yes	No	Yes	No	Yes	No	No	Yes[1]	No
Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No
No	No	No	No	Yes	No	No	No	Yes	Yes
Yes	Yes	No	Yes	No	Yes	No	No	Yes	No
No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No
Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No
Yes	Yes	No	Yes	No	Yes	No	No	Yes	Yes

[7]Includes source

[8]Includes PC PROBE

[9]Plus $395 for performance analysis

[10]Requires MDS system

fortunately, its complicated set of commands is not easy to remember. CodeSmith-86 could be called the WordStar of debuggers—lots of power but not very easy to learn.

Calling Visual Age for technical support can be a pleasant surprise. Instead of listening to "Moon River" while waiting for the inevitably inexperienced support person to answer, the caller can talk directly to the author of the program. But don't call before noon Pacific time. The author reserves that morning time to implement the latest set of suggested features.

For a detailed review of CodeSmith-86, see "Two New Ways to Drive the Bugs Away," (Ray Duncan, May 1984, p. 110).

Mylstar Symbolic Debugging Program (Mylstar). Some companies don't believe in reinventing the wheel; Mylstar is one of them. Rather than building a debugger from ground up, Mylstar elected to base MSD on, of all things, IBM DEBUG.

Before using MSD, you must run an installation program that marries MSD to DEBUG.COM. The result of this marriage is a few enhanced IBM DEBUG commands and 32 new commands that provide support for symbolic debugging, macros, and other features.

At $125, MSD is an inexpensive but attractive symbolic debugger for those who just can't tear themselves away from IBM DEBUG, but who wouldn't mind bringing their debugging capabilities up to date.

SOFTWARE PROBE (ATRON). ATRON's primary product is a hardware-assisted debugger called PC PROBE. SOFTWARE PROBE is the same product minus the circuit board, but plus a special bonus: a combination stop and reset button that stops a wild program from executing and returns to the debugger without erasing the contents of memory.

It makes a lot of sense for a software development house to have the same debugger available in a hardware-assisted version and in a less expensive software-only version. Not everyone on the programming staff needs a $2,000-plus, hardware-assisted debugger. But when a nasty problem needs diagnosis, it's comforting to know that a heavy-duty tool is available. And if both debuggers speak the same language, that's just icing on the cake.

GeneScope (Genesis Microsystems). Like SOFTWARE PROBE, GeneScope is

TABLE 1: *Debugger Features*

	DISPLAY PUBLIC SYMBOLS INSTEAD OF ADDRESSES	SET BREAKPOINTS IN OVERLAYS	HARDWARE BREAKPOINTS	PROGRAM BACK TRACE	REDUCED-SPEED PROGRAM TRACE	SINGLE STEP PAST CALLS AND INTERRUPTS	UNASSEMBLE INSTRUCTIONS	HEXADECIMAL ARITHMETIC
IBM DEBUG 2.1	No	No	No	No	No	No	Yes	Yes
TRACE86 1.09A	No	No	No	Limited	Yes	Yes	Yes	Yes
PC-TEST 1.0	No	No	No	No	No	Yes	Yes	No
87DEBUG 1.0	No	No	No	No	No	Yes	Yes	No
PFIX86 1.01	No	No	No	No	No	Interrupts	Yes	Yes
CODESMITH-86 1.8	Yes	No	No	No	Yes	Yes	Yes	Yes
MYLSTAR 2.0	Yes	No	No	No	No	Yes	Yes	Yes
SW PROBE 1.5	Yes	No	No	No	Yes	Yes	Yes	Yes
GENESCOPE 1.0	Yes	No	No	No	No	Yes	Yes	Yes
PFIX86PLUS 1.02	Yes[1]	Yes[1]	No	No	No	Interrupts	Yes	Yes
SYMD 1.01	Yes	No	No	Yes[2]	Yes	Calls	Yes	Yes
BUGSCREEN 1.0	Yes	No	No	No	No	Yes	No[3]	No
PERISCOPE 1.0	Yes	No	No	No	Yes	No	Yes	Yes
SOFT-SCOPE 1.1	Yes	Yes	No	Yes[2]	Yes	No	Yes	No
SW SOURCE PROBE 1.0	Yes	No	No	No	Yes	Yes	Yes	Yes
SOURCE PROBE 1.0	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
PDT-PC 2.0	Yes	No	Yes	Yes	No	Yes	Yes	Yes
PC PROBE 1.15	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
ICE-88 88A	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

[1]If program linked with Plink86
[2]Not real-time
[3]Shows source instead
[4]Reset switch
[5]Security key
[6]Boards

the software version of a hardware-assisted debugger. In this case, the hardware-assisted debugger is Answer Software's PDT-PC. The people at Genesis Microsystems developed the software portion of the PDT-PC for Answer Software, and now they are marketing it under the name GeneScope.

GeneScope includes all the features of the PDT-PC except hardware breakpoints, real-time program trace, assemble to memory, and performance analysis. As with SOFTWARE PROBE, GeneScope is especially handy to use with Answer Software's PDT-PC hardware-assisted debugger; but for a software-only debugger, it's a little high-priced ($995).

In addition, GeneScope requires a serial port into which is plugged a security device—an extreme method of copy-protection.

Pfix86Plus (Phoenix Computer Products Corp.). Pfix86Plus does everything that Pfix86, the assembly language debugger, does, plus it adds symbolic debugging and debugs overlaid code. However, to take advantage of these additional features, Phoenix Software's Plink86 program linker is necessary. (Plink86 was reviewed in "Program Orchestration," Steven Armbrust and Ted Forgeron, *PC Tech Journal*, November 1984, p. 28.) Plink86 and Pfix86Plus form a synergistic team whose capabilities far exceed the sum of the two taken separately.

Plink86 has a SYMTABLE option that allows it to store, in the .EXE file it generates, information about public symbols and local-variable line numbers. Pfix86Plus can extract this information without having to read a separate link map file. This implies a faster-loading debugger, and it makes special map conversion programs unnecessary.

Also, Pfix86Plus has the capability to debug overlaid code. For example, it allows the user to set breakpoints on symbols that reside in overlays—even if the overlay has not been loaded into memory. To our knowledge, Pfix86Plus is the only debugger with this capability.

Periscope (Data Base Decisions). Periscope comes complete with a Submarine, a "Torpedo" switch, and a professional-looking manual.

The Submarine is a special memory board containing 16KB of write-protected memory—enough to hide all of the debugger's code.

PORT I/O	DISK I/O	MACROS	PROGRAM CRASH RECOVERY	PERFORMANCE ANALYSIS	DEBUGGER SOFTWARE MEMORY-PROTECTED	COPY-PROTECTED	HARDWARE SUPPLIED	ON-LINE HELP	PRICE
Yes	Yes	No	No	No	No	No	None	No	W/DOS
Yes	Yes	No	No	No	No	No	None	Yes	$125
No	No	No	Yes	No	No	No	None	Yes	$75[7]
Yes	No	Yes	No	No	No	No	None	No	$150
Yes	Yes	No	No	No	No	No	None	Minimal	$195
Yes	Yes	No	No	No	No	No	None	No	$145
Yes	Yes	Yes	No	No	No	No	None	Yes	$125
Yes	Yes	Yes	Yes	No	No	Yes	Yes[4]	Automatic	$295
Yes	Yes	Yes	No	No	No	Yes	Yes[5]	Yes	$995
Yes	Yes	No	No	No	No	No	None	Minimal	$395
Yes	Yes	No	No	Yes	No	No	None	No	$125
No.	No	No	No	No	No	No	None	Yes	$95
Yes	Yes	No	Yes	No	Yes	Yes	Yes[4,6]	Yes	$295
Yes	Yes	Yes	No	No	No	No	None	Yes	$995
Yes	Yes	Yes	Yes	No	No	Yes	Yes[4]	Automatic	$395
Yes	Yes	Yes	Yes	$395 extra	Yes	Yes	Yes[4,6]	Automaic	$2,695[8]
Yes	Yes	Yes	Yes	Yes	No	Yes	Yes[6]	Yes	$1,775
Yes	Yes	Yes	Yes	$395 extra	Yes	Yes	Yes[4,6]	Automatic	$2,495[9]
Yes	Yes	Yes	Yes	Not explicitly	Yes	N/A	Yes[6]	No	$7,500[10]

[7]Includes source
[8]Includes PC PROBE
[9]Plus $395 for performance analysis
[10]Requires MDS system

It protects the debugger from getting depth-charged by the user's bug-ridden programs.

Once the resident part of the debugger gets loaded into the Submarine, the debugger is out of sight—silent running, so to speak. But if the program should stray into dangerous waters, the "Torpedo" switch will stop it so the user can "dive" into the debugger. (Actually, Data Base Decisions calls it a breakout switch, but we think "Torpedo" switch is more appropriate.)

The debugger itself, which is called the Periscope, helps sink destroyer bugs before they stop the code dead in the water.

All kidding aside, Periscope is a decent symbolic debugger. We didn't classify it as a hardware-assisted debugger, even though it comes with a memory board, because it doesn't have two features that real hardware-assisted debuggers should have: real-time trace and hardware breakpoints. However, the Submarine and the breakout switch are fringe benefits that other symbolic debuggers in its price range do not have.

SYMD Symbolic Debugger (D + V Systems). SYMD is really a clone of IBM DEBUG that also includes support for symbols plus three key enhancements: real-number support, a back trace of previous instructions, and a built-in profiler.

Programmers who are using a compiler that supports the 8087 numeric coprocessor directly (or emulates the 8087) will like SYMD's real-number support. With it, the contents of REAL variables can be changed. The SYMD debugger supports the three most popular real-number formats: IEEE 8087 double precision, IEEE 8087 single precision, and Microsoft format.

SYMD's back trace feature allows it to display the most recent 255 instructions. This is a useful feature that lets the user review the events that lead up to a problem. However, a price is paid for this power: while in back-trace mode, the executing program runs much slower than normal. This is in contrast to hardware-assisted debuggers, which provide a program trace in real time.

Finally, SYMD contains a nifty built-in profiler that helps answer the question, "Why is this program running so slowly, and where is it spending all of its time?" The pro-

filer has two sampling modes: by trace and by timer interrupt. Even though this is not as complete as the performance-analysis software offered with PC PROBE (as a $395 option), the SYMD profiler is included in its $125 purchase price. As such, it's a real bargain.

BUGSCREEN (RDT Software). BUGSCREEN is a different breed of animal than the other debuggers in this article. It's like a mongrel—not really a poodle and not really an Irish Setter—but it is a debugger that a programmer could learn to love with a little time.

This half-breed is really an assembly language debugger, and part of it must actually be linked to the assembly code. But BUGSCREEN has so many of the features of symbolic debuggers that we decided to categorize it as such.

Because BUGSCREEN is linked to code, it can use all the symbols in a program, not just the public symbols. It even has a window that shows the source listing (complete with comments) with the current instruction highlighted.

Programmers who debug IBM or Microsoft Macro Assembler code should look closely at BUGSCREEN. Those who use a high-level language should forget BUGSCREEN.

HIGH-LEVEL LANGUAGE DEBUGGERS

Soft-Scope (Concurrent Sciences). Soft-Scope is a truly new variety of debugger, a pure high-level language debugger. With it a programmer can debug the same code he wrote, not an assembly language translation of it. Throw out that macro assembler reference manual.

So why doesn't everyone buy a copy of Soft-Scope and quit looking at MOVs and POPs? Well, it's not quite as easy as that.

Soft-Scope is a generic high-level language debugger that is not tied to a specific language or compiler, but it does require the use of a compiler that generates Intel-style detailed debugging records in its .OBJ files. Those Intel languages require a special environment, such as the iRMX 86 operating system or UDI (Universal Development Interface), in which to run. Worse yet, Intel languages are very expensive.

SOFTWARE SOURCE PROBE (ATRON). This debugger is an enhanced version of ATRON'S SOFTWARE PROBE. The main difference between it and SOFTWARE PROBE is that SOFTWARE SOURCE PROBE displays source code on the debugger screen, instead of unassembled assembly language instructions. It also allows source code to be edited during the debugging session.

How is this different from what Soft-Scope does? First, with SOFT-

MEMO: C Programmers

QUIT WORKING SO HARD.

These people have quit working so hard: IBM, Honeywell, Control Data, GE, Lotus, Hospitals, Universities & Government Aerospace.

THE GREENLEAF FUNCTIONS™

THE library of C FUNCTIONS that probably has just what you need . . . **TODAY!**

. . . already has what you're working to re-invent
. . . already has over 200 functions for the IBM PC, XT, AT, and compatibles
. . . already complete . . . already tested . . . on the shelf
. . . already has demo programs and spurce code
. . . already compatible with all popular compilers
. . . already supports all memory models, DOS 1.1, 2.0, 2.1
. . . already optimized (parts in assembler) for speed and density
. . . already in use by thousands of customers worldwide
. . . already available from stock (your dealer probably has it)
. . . It's called the **GREENLEAF FUNCTIONS.**

Sorry you didn't know this sooner? Just order a copy and then take a break — we did the hard work. Already.

THE GREENLEAF FUNCTIONS GENERAL LIBRARY: Over 200 functions in C and assembler. Strength in DOS, video, string, printer, async, and system interface. All DOS 1 and 2 functions are in assembler for speed. All video capabilities of PC supported. All printer functions. 65 string functions. Extensive time and date. Directory searches. Polled mode async. (If you want interrupt driven, ask us about the **Greenleaf Comm Library**.) Function key support. Diagnostics. Rainbow Color Text series. Much, much more. **The Greenleaf Functions.** Simply the finest C library (and the most extensive). All ready for you. From Greenleaf Software.

. . . **Specify compiler** when ordering. Add $7.00 each for UPS second-day air. MasterCard, VISA, check, or P.O.

- Compilers:
  - CI C86 . . . . . $349
  - Lattice $395
  - Mark Williams . . . $475
- General Libraries . . . . $175 (Lattice, Microsoft, Mark Williams, CI C86)
- (DeSmet C) $150
- Comm Library $160

GREENLEAF SOFTWARE©

GREENLEAF SOFTWARE, INC.

2101 HICKORY DRIVE ◆ CARROLLTON, TX 75006 ◆ (214) 446-8641

CIRCLE NO. 105 ON READER SERVICE CARD

WARE SOURCE PROBE, the user must give the name of a source file for each module name in his program's link map. SOFTWARE SOURCE PROBE uses this information to associate lines of code in the source program with line-number information in the link map. Supplying this information could be quite tedious, except that ATRON has provided such first-class macro support that the user can build a macro to automate the entire process.

PDT-PC's main claim to fame is that every operation is lightning fast. It disassembles code faster than any of the other debuggers tested.

Second, because SOFTWARE SOURCE PROBE operates on .EXE or COM files that do not contain the full complement of debug information, it does not support the manipulation of local variables and local procedures. This means that the debugger cannot be made to refer to local variable "i" unless "i" is declared public.

HARDWARE-ASSISTED DEBUGGERS

PDT-PC (Answer Software). PDT-PC is our pick of the hardware-assisted debuggers for two reasons. It has a fast, programmer-friendly user interface, and costs about half as much as its most serious competitor.

PDT-PC's main claim to fame is that every operation is lightning fast. It disassembles code faster than any of the other debuggers tested.

Its user interface is amazingly simple and easy to remember. A command bar always appears in the middle of the screen. Code above the command bar is actually a trace of instructions that have already executed. Code below the command bar contains unassembled instructions that have yet to execute. To move through the trace, or through the unexecuted code, use the cursor keys. Better yet, the PgUp and PgDn keys can be used. This simple approach eliminates the need for the verbose commands that the other hardware-assisted debuggers use to accomplish the same thing.

PDT-PC uses the PC's memory for the debugger code and symbol space. Although not as secure as having protected memory on the debugger board itself, this cost-cutting measure allows Answer Software to sell the PDT-PC for much less than its competition.

PC PROBE (ATRON). PC PROBE, the big brother of SOFTWARE PROBE, has several features that make it the hands-down choice for debugging tough systems-software problems. For the programmer who wrestles daily with operating systems, multitasking software, loaders, device drivers, or interrupt handlers, PC PROBE may be the right choice, in spite of its cost.

For most people, $2,495, plus an extra $395 for the performance-analysis software (which PDT-PC includes at no extra charge), seems like a lot to pay. But remember, time is money; it's easy to waste $2,500 worth of time by using primitive debugging tools.

SOURCE PROBE (ATRON). SOURCE PROBE combines the features of SOFTWARE SOURCE PROBE and PC PROBE, making it both a high-level language debugger and a hardware-assisted debugger. It does, however, add another noteworthy feature that none of the other debuggers in this survey includes.

The added feature is the ability to display the contents of the real-time trace buffer as lines of source code instead of assembly language instructions. The trace buffer often contains clues to what happened just prior to a program crash. See-

CIRCLE NO. 143 ON READER SERVICE CARD

ing the clues as source statements instead of as unassembled code can speed up detective work.

IN-CIRCUIT EMULATORS

ICE-88 (Intel). We have only one thing to say about ICE-88: don't use it unless you absolutely must. It's a poorly documented, extremely complex product that was developed in the bowels of an Intel R & D lab to help solve the deep, dark mysteries of hardware and software interaction.

Earlier in our careers, we had many occasions in which to use ICE-88's twin brother, ICE-86, while debugging Intel's real-time iRMX 86 operating system. Our emotions often alternated between cries of joy—when some obscure feature of ICE helped us crack a bewildering bug that prevented our software from running on prototype hardware—to screams of pain—as ICE tortured us with its wordy command structure and its snail's-pace loading of programs.

In today's world of personal computers, a programmer is just as well off with a good hardware-assisted debugger. They are less expensive, easier to use, and provide all the debugging power that 99 percent of PC software developers need. Leave the in-circuit emulators to the people at Intel and to others like them. They are the only ones who need the extra power bad enough to put up with all of the disadvantages.

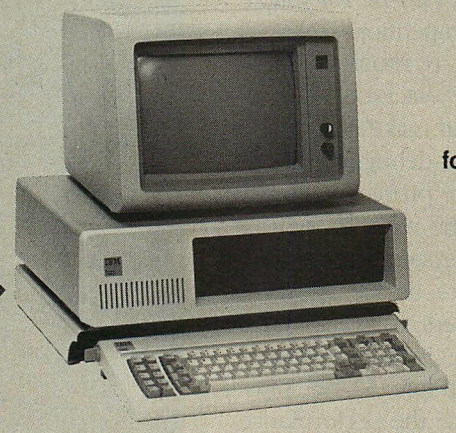
Such a wide variety of debuggers is now available that programmers need to choose them the same way serious writers choose their word processors.

MORE ON THE HORIZON

It's an exciting time for PC debuggers. A year ago there were only two or three. Today, this article surveys 19 of them. And new debuggers with even more powerful features will probably be showing up in the marketplace in the very near future.

Even though choosing from among these new products is difficult, this onslaught of new debuggers can only be good news for all programmers. Instead of a single debugger, IBM DEBUG, there are debuggers for every need and every

HIDEY™



HIDEY hides here

HIDEY gives more for your money

$1795 (list)

10MB Hard Drive . . . with Extra Benefits*

HIDEY provides everything you expect from a hard drive plus many more conveniences because it is designed the way an add-on hard drive should be. All other add-on hard drives require the user to give up either desk space or floppy drive space. Ours doesn't!

HIDEY comes complete with controller, documentation and cables. Just plug it in and start operating our HIDEY with your IBM-PC™ or compatible using DOS 2.0 or higher.

COMPARISON OF ADD-ON HARD DRIVES	Internally mounted	Externally mounted	HIDEY by PMC
10MB hard disk drive and controller	✓	✓	✓
Self-contained power supply		✓	✓
Keep existing floppy drive space		✓	✓
No need for additional desk space	✓		✓
* Provides storage area for keyboard			✓
* Power strip with transient protection			✓
* Consolidates all power cords			✓
* Single power switch for peripherals			✓
* Easier physical access to floppies			✓
* Elevates monitor for better viewing			✓

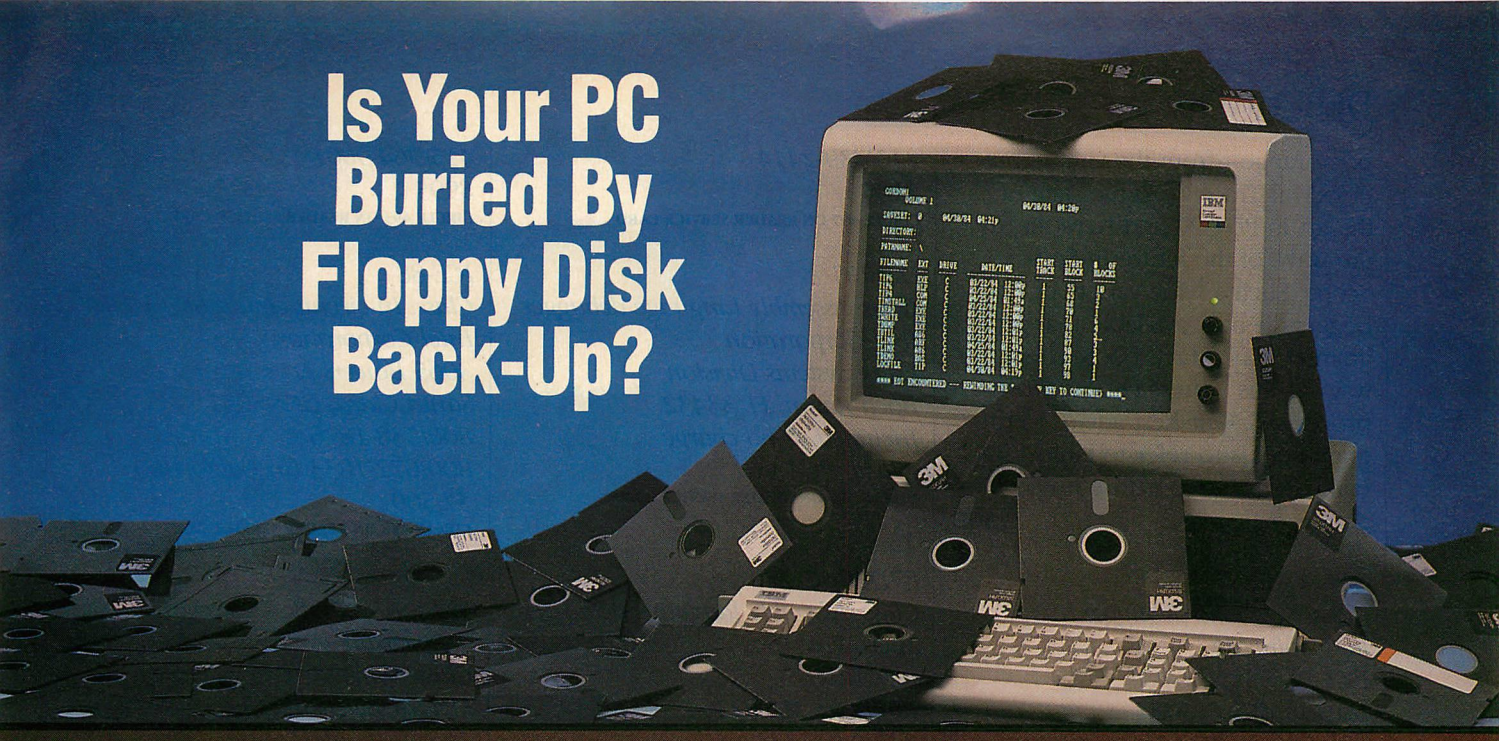
In case you like HIDEY's conveniences but don't need a hard drive, order a bare HIDEY with case and power strip for just $149 (list).

™ IBM-PC is a trademark of IBM Corporation,
HIDEY is a trademark of Personal Micro Computers, Inc.

Personal Micro Computers, Inc. 275 Santa Ana Ct., Sunnyvale, CA 94086 (408) 737-8444

CIRCLE NO. 156 ON READER SERVICE CARD

Is Your PC Buried By Floppy Disk Back-Up?



Dig Out With Model 70 PC Cartridge Tape System

Digi-Data's Model 70 PC cartridge tape system lets you back-up your PC's Winchester drive without getting buried in floppies. One cartridge holds 16.5 Mbytes of data, more than you can put on 51 floppy disks! And you can back-up your 10 Mbyte PC XT® drive in less than 15 minutes of *unattended* operation. That is a small fraction of the time it would take with the PC's floppy, with you standing there changing disks.

Our file-oriented structure makes it possible for you to back-up only what has to be changed on your disk. That saves still more time and storage capacity.

70 PC comes ready to run on your IBM PC XT and most compatibles like Compaq, Columbia Data Products and Eagle. Complete with controller board, driver software and cables.

Digi-Data's products also include 1/2 inch and 1/4 inch start/stop and streaming drives and systems.

DIGI-DATA CORPORATION

®... First In Value

8580 Dorsey Run Road
Jessup, MD 20794
(301) 498-0200 Telex 87580

In Europe contact:

DIGI-DATA LTD
Unit 4
Kings Grove
Maidenhead, Berkshire
England SL6 4DP
Tel. 0628-29555-6
Telex 847720

® PC XT is a registered trademark of IBM Corporation

CIRCLE NO. 134 ON READER SERVICE CARD

price range—from the simple but powerful Trace86, to the state of the art in PDT-PC and PC PROBE, to the wave of the future in SoftScope. Such a wide variety of debuggers is now available that programmers need to choose them the way serious writers choose word processors. Our best advice to programmers is to refer to table 1 and compare features before buying a debugger.

BUGSCREEN
Class: Symbolic debugger
RDT Software
P.O. Box 3216
Lawton, OK 73502
405/536-2078
$95
CIRCLE 490 ON READER SERVICE CARD

CodeSmith-86
Class: Symbolic debugger
Visual Age
642 Larchmont Blvd.
Los Angeles, CA 90004
213/439-2414
$145
CIRCLE 497 ON READER SERVICE CARD

DEBUG
Class: Assembly language debugger
IBM Corporation
Entry Systems Division
Boca Raton, FL 33432
Included at no charge with PC-DOS
CIRCLE 500 ON READER SERVICE CARD

87DEBUG
Class: Assembly language debugger
MicroWay, Inc.
P.O. Box 79
Kingston, MA 02364
617/746-7341
$150
CIRCLE 498 ON READER SERVICE CARD

GeneScope
Class: Symbolic debugger
Genesis Microsystems
196 Castro Street
Mountain View, CA 94041
415/964-9001
$995
CIRCLE 493 ON READER SERVICE CARD

ICE-88
Class: In-circuit emulator
Intel Corporation
3065 Bowers Avenue
Santa Clara, CA 95051
800/538-1876
800/672-1833 (in California)
$7,500
CIRCLE 486 ON READER SERVICE CARD

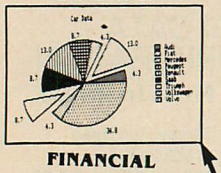
Mylstar Symbolic Debugging Program
Class: Symbolic debugger
Mylstar Electronics Inc.
165 West Lake Street
Northlake, IL 60164
312/562-7400
$125
CIRCLE 494 ON READER SERVICE CARD

PC-Test
Class: Assembly language debugger
A.J.M. Associates

EXEC*U*STAT™

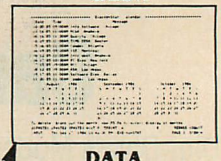
Advanced Software for Today's Executives

PRESENTATION GRAPHICS



While you're still using your favorite spreadsheet package . . . How would you like to have:

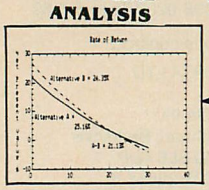
EXECUTIVE DESK



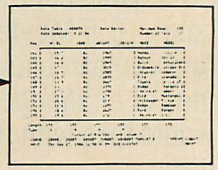
Other Features:

SMOOTHING	SEASONAL ADJUSTMENT
PULL-DOWN CALCULATOR	ANALYSIS OF VARIANCE
SCRATCH PAD	SLIDE FACILITY
CROSS TABULATION	PLOTTERS
TELEPHONE BOOK	NET PRESENT VALUE
NONLINEAR MODELS	INTERNAL RATE OF RETURN

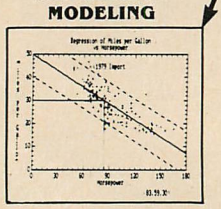
FINANCIAL ANALYSIS



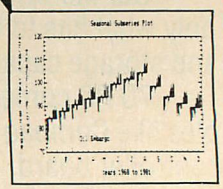
DATA MAINTENANCE



REGRESSION MODELING



FORECASTING



. . . and a lot more!

Make the executive move to

EXEC*U*STAT™

EXEC*U*STAT INC.

Research Park, 2 Wall Street Princeton, NJ 08540 (609) 924-9357

CIRCLE NO. 135 ON READER SERVICE CARD

Box 54068
San Jose, CA 95154
$75
CIRCLE 495 ON READER SERVICE CARD

PDT-PC
Class: Hardware-assisted debugger
Answer Software Corp.
20863 Stevens Creek Blvd., B2-C
Cupertino, CA 95014
408/253-7515
$1,775
CIRCLE 487 ON READER SERVICE CARD

Periscope
Class: Symbolic debugger
Data Base Decisions
14 Bonnie Lane
Atlanta, Georgia 30328
404/256-3860
$295
CIRCLE 489 ON READER SERVICE CARD

Pfix86
Class: Assembly language debugger
Pfix86Plus
Class: Symbolic debugger
Phoenix Computer Products Corporation
1416 Providence Highway
Suite 220
Norwood, MA 02062
617/769-7020
$195 (Pfix86)
$395 (Pfix86Plus)
CIRCLE 496 ON READER SERVICE CARD

Soft-Scope
Class: High-level language debugger
Concurrent Sciences
P.O. Box 9666
Moscow, ID 83843
208/882-0445
$995
CIRCLE 488 ON READER SERVICE CARD

SOFTWARE PROBE, $295
Class: Symbolic debugger

SOFTWARE SOURCE PROBE, $395
Class: High-level language debugger

PC PROBE, $2,495
Class: Hardware-assisted debugger
SOURCE PROBE, $395
Class: Hardware-assisted and high-level language debugger

ATRON
20665 Fourth Street
Saratoga, CA 94041
408/741-5900
CIRCLE 492 ON READER SERVICE CARD

SYMD
Class: Symbolic debugger
D+V Systems
400 Amherst Street
Nashua, NH 03063
603/881-7140
$125
CIRCLE 491 ON READER SERVICE CARD

Trace86
Class: Assembly language debugger
Morgan Computing Company, Inc.
10400 North Central Expressway
Dallas, TX 75231
214/739-5895
$125
CIRCLE 499 ON READER SERVICE CARD

Can your editor work with 16,000,000 bytes of memory?

SPF/PC™ 1.8 from CTC can!

The best full screen editor for the IBM PC is now even better than ever. It looks and works like IBM's large system SPF editor, but SPF/PC executes faster and handles larger files than its mainframe cousin.

AT EXTENDED MEMORY
SPF/PC can use up to 15,850 KB of memory.

TOP VIEW COMPATIBLE
SPF/PC supports windowing and background execution.

COMMUNICATIONS FEATURE
Easy to use communications software.

$195
UPGRADES only $50
($10 if communications upgrade)
Add $5 for shipping
Canada $10 Foreign $15
MasterCard VISA
Check or purchase order accepted.

FAMILY TIES
- **SPF/PC** is used by IBM to demonstrate the IBM 3270/PC to its corporate clients
- **SPF/PC** provides the same outstanding performance on any PC, from JR to AT
- **SPF/PC** works with DOS 1.00–3.00 and any IBM PC or true compatible with 192K

IBM is a registered trademark of International Business Machines, Inc. SPF/PC is a registered trademark of Command Technology Corporation.

TO ORDER SPF/PC...

Contact: Command Technology Corporation
1900 Mountain Boulevard
Oakland, CA 94611

(415) 339-3530
Telex: 509330

CIRCLE NO. 207 ON READER SERVICE CARD

COMMUNICATIONS SOFTWARE THAT INTEGRATES WITH ANY PROGRAM.

SOFTERM IS ALSO AVAILABLE IN VERSIONS FOR APPLE II® AND TANDY 2000 PERSONAL COMPUTERS.

TERMINAL EMULATIONS

TTY Compatible	HP 2622A
ADDS Regent 20	Honeywell VIP7205
ADDS Regent 25	Honeywell VIP7801
ADDS Regent 40	Honeywell VIP7803
ADDS Regent 60	IBM 3101 Model 10
ADDS Viewpoint	IBM 3101 Model 20
Data General D200	Lear Siegler ADM-3A
Datapoint 3601	Lear Siegler ADM-5
DEC VT52	TeleVideo 910
DEC VT102	TeleVideo 925
Hazeltine 1400/1410	TeleVideo 950
Hazeltine 1500	User Defined
Hazeltine 1520	

Here's the first software that lets you integrate communications with all your favorite programs. Now you can add concurrent communications to programs like Lotus 1-2-3,™ dBase III,™ WordStar,® or any other IBM PC compatible software. Softerm PC™ can function two ways—as a stand-alone program or as an extension to your PC-DOS operating system to let you access Softerm's capabilities while using other programs.

Simple to use.

Softerm PC lets you interrupt any program simply by pressing one key. You can then use disk utilities, print a file, dial a host computer, use terminal mode, or initiate a file transfer. Then you can continue working in the original program while the other tasks are performed concurrently. You can even receive electronic mail while you work.

Hooks your PC to any mainframe.

Softerm PC lets you access information services, bulletin boards, electronic mail systems, and even your company's computer. It has all the features you need, including keyboard macros, built-in phone book for automatic dialing, and simultaneous capture to print or disk. Softerm's extensive file transfer capabilities include automatic execution using command files, support for popular protocols like XMODEM, and our own Softrans™ protocol which includes an adaptable source program for your host computer.

Do it all together. In real time.

Softerm PC supports concurrent operation of up to 4 communications ports and 3 printer ports through background processing queues. Now you can operate your system to its full potential by simultaneously using your available ports for printing or communications functions. Real-time scheduling eliminates unnecessary pauses and gives maximum throughput for smooth, efficient operation.

Complete emulation of 24 terminals.

Softerm PC is not limited to basic TTY terminal emulation. It includes *exact* emulations of 24 popular terminals and provides all keyboard and display functions. Also, both conversational and block modes are supported. If Softerm PC is not completely compatible with your application, return it for a full refund.

The best communications software on the market.

Right now you can buy the best communications software on the market for only $295. And that's a real bargain when you consider all the things Softerm PC will do. Plus, you get an unconditional 30-day money-back guarantee. So ask your dealer for a demonstration today.

SOFTRONICS

3639 NEW GETWELL ROAD, SUITE 10
MEMPHIS, TENNESSEE 38118, (901) 683-6850

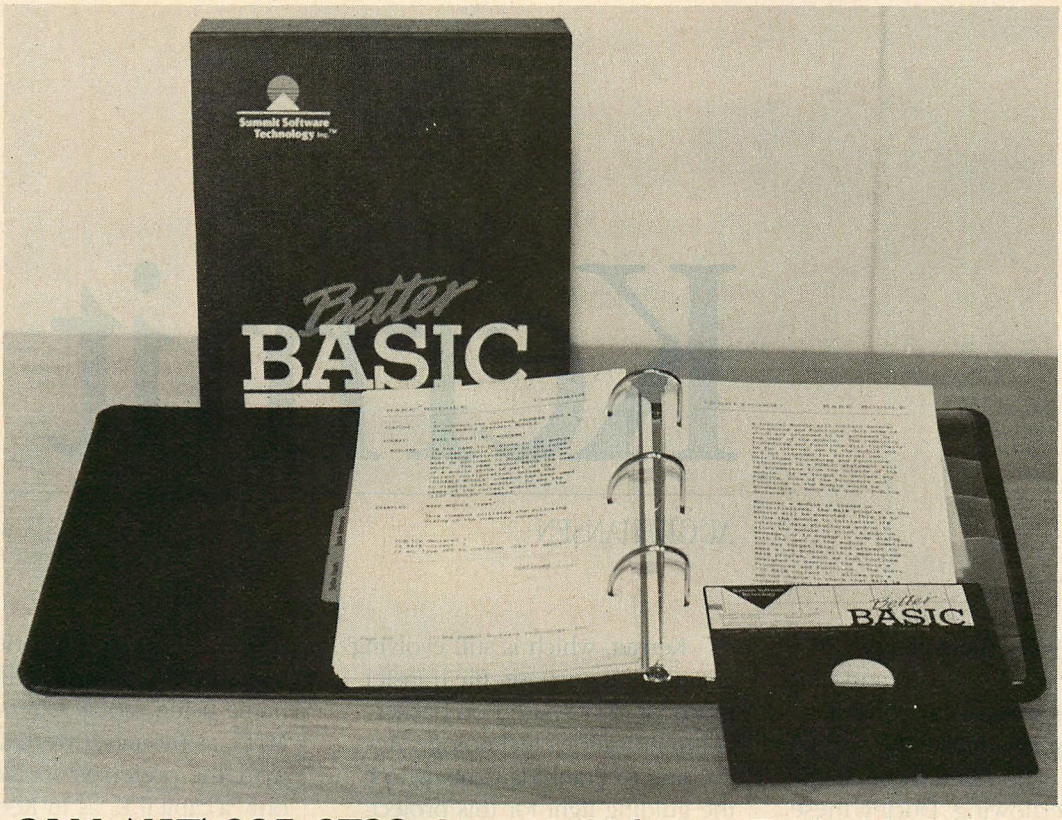
CIRCLE NO. 171 ON READER SERVICE CARD

WHY WOULD ANY SANE PERSON SPEND $199 FOR A BetterBASIC SYSTEM WHEN DOS's IS FREE?

HERE ARE 10 REASONS:
TEST YOUR SANITY

1. Full support for 640K memory **2.** Structured language with BASIC syntax **3.** Separately compiled program modules **4.** Speed: FAST **5.** Extensibility (Make your own BASIC.) **6.** User-defined procedures and functions **7.** Built-in windows support **8.** Interactive programming language based on an incremental compiler **9.** 8087 math support **10.** Runs on IBM PC, IBM PC/XT and compatibles

SANE PROGRAMMERS ORDER BetterBASIC NOW



CALL (617) 235-0729. Summit Software Technology, Inc.™
P.O. Box 99, Babson Park, Wellesley, MA 02157
Price: $199 Sample Disk $10
8087 Math Module: $99 Runtime System: $250

NOW AVAILABLE FOR THE TANDY 2000 & 1200

Better BASIC™

BetterBASIC is a trademark of Summit Software Technology, Inc. IBM PC, IBM PC/XT and PC/DOS are trademarks of International Business Machines Corp. MS-DOS is a trademark of Microsoft Corp.

MasterCard, VISA, P.O. Checks, Money Orders, and C.O.D. accepted.

CIRCLE NO. 177 ON READER SERVICE CARD

Kermit

AUGIE HANSEN

In the 1960s, the primary concern of most colleges and universities was to stay solvent while trying to educate the masses of students who filled these institutions to overflowing. During these years, draft cards were regularly burned, and millions of Hollerith cards were folded, stapled, and mutilated beyond recognition. Somehow, both the students and the institutions survived, and they now face new and, in some ways, even greater challenges in the 1980s. The latest challenge may well be in communications.

Anyone involved in computer and communications systems on university campuses has seen the problem firsthand. Large mainframe systems in computation centers and minicomputers and personal computers in every nook and cranny need to share data. Each computer system, however, has its own way of doing things and often its own special "language." A common way of transferring data is needed, and Columbia University and other universities around the world have been working diligently to provide it.

Kermit, which is still evolving, is a general-purpose, file-transfer protocol (FTP) based on packet-communications technology. According to Frank da Cruz, who is the guiding light for this project, the name *Kermit* is used with permission of Henson Associates, creators of the frog puppet of that name. Daphne Tzoar, who programmed the MS-DOS version (among other versions), tried to come up with a definition for this nonacronym. Thus, the phrase "KL10 Error-free Reciprocal Micro Interconnect over TTY-lines" is buried in the comment block at the start of the assembly language source. Although the writers of some of the manuals spell the name using capital letters (KERMIT), as though it were an acronym, the preferred spelling uses only a capital K, as in Kermit.

Many people believe that Kermit is a technical success and that it will stand tall for a long time to come.

Kermit has been placed in the public domain, which helps to insure its success by making it widely available; to be accepted as more than a mere curiosity, however, Kermit has to be a technical success as well. Many people believe that it is such a success and that it will stand tall for a long time to come.

ADVANCED FEATURES

The Kermit protocol is not tied to any particular machine, architecture, programming language, or transmission medium. It is equally at home on micros, mainframes, and everything in between. It is aptly described as a portable protocol by its developers.

By using a trick called *eighth-bit quoting*, which enables binary files to be transferred as if they contained pure ASCII text, Kermit accommodates many types of host computer systems, including those

A general-purpose file-transfer protocol, developed on college campuses, now is graduating into the real world.

that insist on using the high bit of a byte (character) for parity.

Directory (multiple-file) transfers are possible with most Kermit implementations because the protocol sends the file name as part of the data sequence. Ambiguous file names, those containing wildcard characters such as the "?" and "*" of MS-DOS, may be used to send and request groups of files. Filename transformations are performed, if necessary.

For example, a file name in UNIX may be as long as 14 characters, and the dot (.) is considered as just an ordinary character; unlike in MS-DOS, file names are not required to have a name part and an optional extension part separated by a dot. Therefore, when a file is sent from UNIX to an IBM PC, Kermit may have to modify the file name to make it acceptable to PC-DOS. It does so by truncating long names and, in some cases, by creating unique names to avoid overwriting an existing file.

Most Kermit implementations have a REMOTE command to permit commands to be sent to a remote system operating in the Server mode. Only a few Kermits currently support the Server mode, but this capability will be added to more versions as time and experience demonstrate its value.

An important aspect of any communications protocol is its ability to detect and correct errors, both in the transmitted data and in overall operation. Kermit exhibits intelligent error-recovery capabilities for most situations, including line hang-up, stopping at either end of the path (because of lost power, for instance), and disk- or directory-full conditions. Kermit uses one of three types of packet verification, from a single-byte checksum to a three-byte CRC. The verification method is selectable by the user.

DESIGN CONSIDERATIONS

The complexities that are associated with data communications can be overwhelming, even to relatively experienced users. Compatibility problems often occur because of the great diversity of computer systems. Noise, distortion, and just plain foul-ups on less-than-perfect transmission lines also occur. In addition, of course, operational errors, attributable to users, must be dealt with. Some of the problems faced by the designers of Kermit and their attempts to solve these problems are described below.

Because of the wide range of computers, operating systems, and transmission media with which the program must interact, Kermit is designed to be flexible. No single convention will work in all cases, so there are several variations on the central theme. The XMODEM protocol, although quite useful, is rigid and not applicable in many situations—for example, data cannot be transmitted over data paths that are limited to seven data bits plus a required parity bit. Kermit allows variations to accommodate this and many other variable characteristics of diverse end-to-end systems. Two Kermit systems agree in advance, via *send-init packets*, on

Augie Hansen, who is a contributing editor to this magazine, owns Omniware, a Denver-based software development and training company. He writes frequently about communications products.

The C Compiler Thousands Rely On

C-86™

NEW-IMPROVED Version 2.2 Compiles 25% Faster IBM-PC AT Support

When the going gets tough, Optimizing C86 comes through time and time again. C86 is a highly dependable C compiler that has been optimized through the years to provide the best combination of reliability, speed, and performance.

FAST, IN-LINE 8087/80287 SUPPORT

Now you can take full advantage of 8087/80287 capabilities, allowing your programs to run many times faster than possible with other C compilers. Plus the source code to all routines is included, so you have complete control over all functions.

MORE OF THE FEATURES YOU WANT

- **SOURCE** is provided to all libraries for total programming control. The source includes a set of standard UNIX routines plus many DOS specific functions.
- **SPECIAL IBM-PC LIBRARY** including communication, screen, and keyboard handling functions.
- **COMPATIBLE WITH WIDELY AVAILABLE LIBRARIES** such as HALO screen graphics and many, many others (call for list).
- **TOPVIEW SUPPORT LIBRARY** provides windowing capabilities.
- **SPEED OPTIMIZATION** — there's always room to tighten your code, and Computer Innovations has the tools to help. For example, *PROFILER-86* helps identify key areas for optimization.

TECHNICAL SUPPORT, NOBODY DOES IT BETTER

Computer Innovations has earned a reputation for providing customer support that is **unequalled** in the industry. This includes a user's group, an on-line bulletin board, and a user's newsletter.

JOIN THE THOUSANDS OF PROGRAMMERS WHO TRUST AND RELY ON C86

For Further Information Call 800-922-0169.

Technical Assistance Call (201) 542-5920.

Computer Innovations features a full line of C products including **C-to-Dbase** (Dbase development tool) and **Introducing C** (C Interpreter Language Learning System). Call or write for a product profile.

COMPUTER INNOVATIONS, INC.

980 Shrewsbury Avenue, Tinton Falls, NJ 07724

For Further Information Call

800-922-0169

Technical Assistance Call (201) 542-5920

© 1984 Computer Innovations, Inc.

CIRCLE NO. 129 ON READER SERVICE CARD

which capabilities each can use effectively, in addition to agreeing on the use of various time-out periods, padding and termination characters, packet lengths, etc.

To keep the speed of communications as high as possible within the limitations of the physical link, Kermit uses a rudimentary form of data compression and a quoting mechanism for special characters; both ends of the link must have these capabilities.

A repeat count, which may be as large as 94, is used to compress multiple occurrences of the same character. Longer runs of a character must be broken into chunks of 94 or fewer characters to be sent correctly. Such runs occur most often in executable program files, typically as a result of reserved buffer space that is set to all zeros or some other value. Such files benefit most from this type of compression.

Quoting has the opposite effect: it increases the size of a transmitted file, because extra bytes are used to permit nonprinting or non-ASCII characters to be passed by seven-bit-only physical links. Many mainframe systems, including IBM's, require that the high bit in every byte be used for parity. It cannot be ignored or used for some other purpose, so a means of circumventing this limitation is needed.

Rather than convert an entire binary file to printable ASCII form, Kermit converts only those characters that are not printable, leaving all others unchanged. Thus, instead of having a 100-percent overhead for binary files, as IBM's Asynchronous Communications Support package does, Kermit will get by with the smallest possible overhead, typically less than 50 percent. Physical paths that permit a full eight bits of data should never use eighth-bit quoting in order to avoid the unnecessary overhead.

Maintaining data integrity between computer systems over typical voice-grade lines is indeed a challenge. Kermit's use of relatively short packets and adjustable repeat and time-out values strikes a good balance between control overhead and data-transmission efficiency. Longer packets would tend to increase the overall efficiency over good paths, but frequent retransmission over bad paths would quickly negate that gain.

Within packets, Kermit allows one of three error-detection methods: 1- or 2-byte checksums or a 3-byte representation of the 16-bit Cyclical Redundancy Check (CRC-CCITT). Not all systems implement all of these methods, so the local and remote systems must agree in advance on which one to use. The Telios package, for example (see "Telios" in this issue, page 124), handles the two checksum methods, but not the CRC method.

In addition to transferring files, people using a local system need to be able to list data—including file names and contents—regarding files on the remote system. A server system, according to Kermit, is one that receives commands in packet form and runs them as if the commands were typed directly by a user on the remote system. This permits remote command execution, which enables a user on a local Kermit system to gain considerable control over the remote system's operation and to query it for needed data. As mentioned previously, some (but not all) Kermit implementations may be placed in the Server mode of operation.

FIGURE 1: *The Open Systems Interconnection Reference Model*

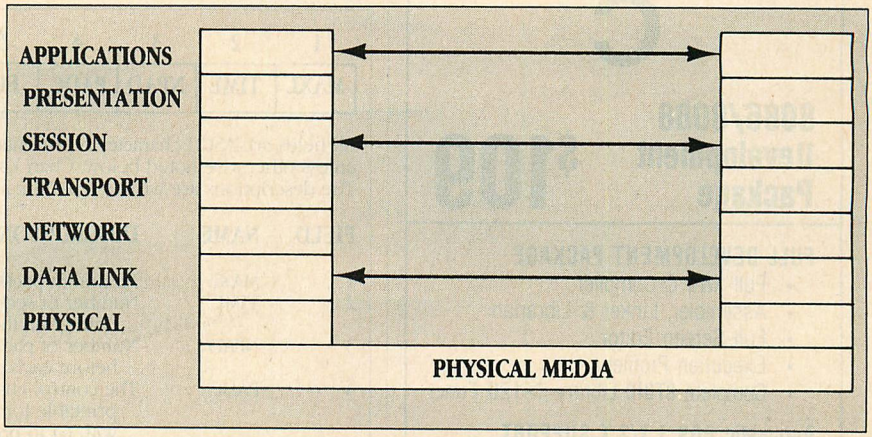
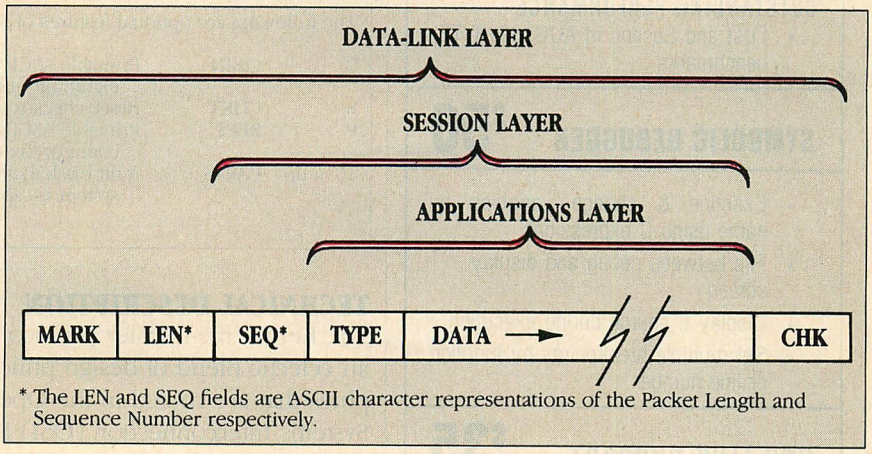


FIGURE 2: *Kermit Packet Format*



* The LEN and SEQ fields are ASCII character representations of the Packet Length and Sequence Number respectively.

DeSmet C

8086/8088 Development Package **$109**

FULL DEVELOPMENT PACKAGE
- Full **K&R** C Compiler
- Assembler, Linker & Librarian
- Full-Screen Editor
- Execution Profiler
- Complete **STDIO** Library (>120 Func)

Automatic DOS 1.X/2.X SUPPORT

BOTH 8087 AND S/W FLOATING POINT

OVERLAYS

OUTSTANDING PERFORMANCE
- First and Second in AUG '83 BYTE benchmarks

SYMBOLIC DEBUGGER **$50**

- Examine & change variables by name using C expressions
- Flip between debug and display screen
- Display C source during execution
- Set multiple breakpoints by function or line number

DOS LINK SUPPORT **$35**

- Uses DOS .OBJ Format
- LINKs with DOS ASM
- Uses Lattice® naming conventions

Check: ☐ Dev. Pkg (109)
☐ Debugger (50)
☐ DOS Link Supt. (35)

SHIP TO: _____

_____

_____ ZIP_____

CWARE CORPORATION

P.O. BOX C
Sunnyvale, CA 94087
(408) 720-9696

All orders shipped UPS surface on IBM format disks. Shipping included in price. California residents add sales tax. Canada shipping add $5, elsewhere add $15. Checks must be on US Bank and in US Dollars. Call 9 a.m. – 1 p.m. to CHARGE by VISA/MC/AMEX.

CIRCLE NO. 214 ON READER SERVICE CARD

FIGURE 3: *The Send-Init Packet Data Field*

1	2	3	4	5	6	7	8	9	10
MAXL	TIME	NPAD	PADC	EOL	QCTL	QBIN	CHKT	REPT	CAPAS . . .

All fields are ASCII character representations of numeric values using char() unless otherwise noted below. Char() adds 32 (ASCII space) to the numeric value. The descriptions are written from the *local* perspective.

FIELD	NAME	DESCRIPTION
1	MAXL	Maximum packet length acceptable (<=96)
2	TIME	Number of seconds remote system should wait before timing out the local system while awaiting a packet
3	NPAD	Number of padding characters the remote should send before each packet
4	PADC	The control character to use for padding, converted to a printable form by ctl (), which XORs the numeric value with 64 to preserve the high bit—this field is ignored if NPAD (field 3) is 0
5	EOL	Character the remote should send to terminate a packet
6	QCTL	Printable ASCII character the local system will send to quote control characters

The following are optional features of Kermit:

7	QBIN	Printable ASCII character local system wants to use for eighth-bit quoting—several options available
8	CHKT	Block check type (checksum-1, checksum-2, or CRC)
9	REPT	Printable ASCII character local system will use to do repeat count prefixing if remote agrees
10 & up	CAPAS	A bit mask that indicates which Kermit capabilities the local system is capable of using

TECHNICAL DESCRIPTION

The Kermit file-transfer protocol is an eclectic blend of design philosophies that are rooted in the Open Systems Interconnection (OSI) Basic Reference Model and related ANSI standards. Kermit is intended to be used only for point-to-point, character-oriented communications over serial data paths.

Figure 1 portrays the OSI Basic Reference Model, which is organized into seven layers. The three horizontal lines represent peer-level communications that are specifically addressed in the design of the Kermit packet.

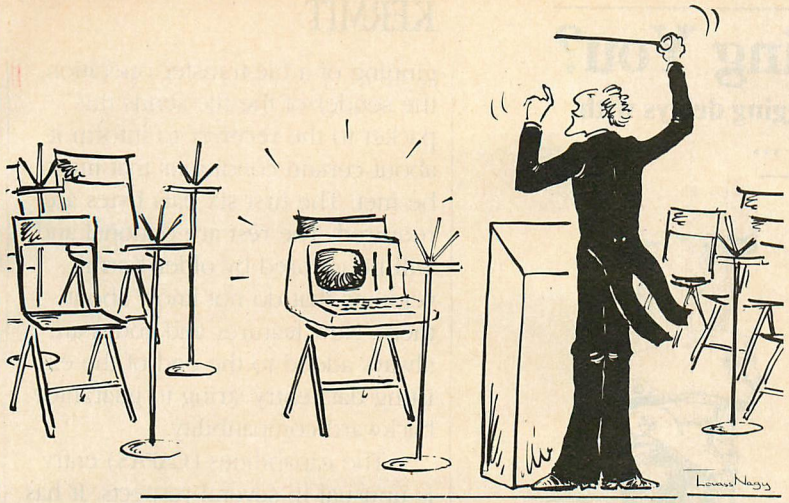
As figure 2 shows, the applications layer is the one in which the file transfer appears to take place. It is the layer closest to the user and the one that is, therefore, most visible. Its concern is the type (TYPE field) of data being transferred and the data (DATA field) itself.

The Reference Model's session layer uses the packet-sequence number (SEQ field) to ignore duplicate packets, if any are sent, and to request packets that are missing. When Kermit is run in a verbose or debugging mode, messages to the user describe what is happening at this level, but no action may be taken by the user, other than terminating the transfer prematurely.

The data-link layer comprises the MARK, LEN, and CHK fields of the packet and has the weighty responsibility of ensuring the safe and accurate delivery of the packet to the receiver.

Several layers either operate invisibly or do not participate at all in Kermit file transfers. The physical layer is the underlying hardware and circuit that connects the local and remote systems. For point-to-point transfers, the network and transport layers play no active role; they are therefore bypassed.

Figure 3 shows the contents of the data field of a packet, in this case the send-init packet. At the be-



Would you hire an entire band when all you need is one instrument? Of course not.

So why use a whole orchestra of computers when all you need is one to develop software for virtually any type of micro-processor?

The secret? Avocet's family of cross-assemblers. With Avocet cross-assemblers you can develop software for practically every kind of processor — *without having to switch to another development system along the way!*

Cross-Assemblers to Beat the Band!

Development Tools That Work

Avocet cross-assemblers are fast, reliable and user-proven in over 4 years of actual use. Ask NASA, IBM, Xerox or the hundreds of other organizations that use them. Every time you see a new microprocessor-based product, there's a good chance it was developed with Avocet cross-assemblers.

Avocet cross-assemblers are easy to use. They run on almost any personal computer and process assembly language for the most popular microprocessor families.

Your Computer Can Be A Complete Development System

Avocet has the tools you need to enter and assemble your soft-ware and finally cast it in EPROM:

VEDIT Text Editor makes source code entry a snap. Full-screen editing plus a TECO-like command mode for advanced tasks. Easy installation - INSTALL program supports over 40 terminals and personal computers. Customizable keyboard layout. CP/M-80, CP/M-86, MSDOS, PCDOS $150

EPROM Programmers let you program, verify, compare, read, display EPROMS but cost less because they communicate through your personal computer or terminal. No personality modules! On-board intelligence provides menu-based setup for 34 different EPROMS, EEPROMS and MPUs (40-pin devices require socket adaptors). Self-contained unit with internal power supply, RS-232 interface, Textool ZIF socket. Driver software (sold separately) gives you access to all programmer features through your computer, lets you download cross-assembler output files, copy EPROM to disk.

Model 7228 Advanced Programmer —Supports all PROM types listed. Superfast "adaptive" programming algorithm programs 2764 in 1.1 minutes.

Model 7128 Standard Programmer — Lower-cost version of 7228. Supports all PROM types except "A" versions of 2764 and 27128. Standard programming algorithm programs 2764 in 6.8 minutes.

Avocet Cross-assembler		Target Microprocessor	CP/M-80	CP/M-86 IBM PC, MSDOS**
XASM04	*NEW*	6804	$ 250.00	$ 250.00
XASM05		6805	200.00	250.00
XASM09		6809	200.00	250.00
XASM18		1802/1805	200.00	250.00
XASM48		8048/8041	200.00	250.00
XASM51		8051	200.00	250.00
XASM65		6502/65C02	200.00	250.00
XASM68		6800/01, 6301	200.00	250.00
XASM75		NEC 7500	500.00	500.00
XASM85		8085	250.00	250.00
XASM400		COP400	300.00	300.00
XASMF8		F8/3870	300.00	300.00
XASMZ8		Z8	200.00	250.00
XASMZ80		Z80	250.00	250.00
XMAC682	*NEW*	68200	595.00	595.00
XMAC68K	*NEW*	68000/68010	595.00	595.00

Model 7956 and 7956-SA Gang Programmers — Similar features to 7228, but program as many as 8 EPROMS at once. 7956-SA stand-alone version copies from a master EPROM. 7956 lab version has all features of stand-alone plus RS-232 interface.

EPROM: 2758, 2716, 2732, 2732A, 2764, 2764A, 27128, 27128A, 27256, 2508, 2516, 2532, 2564, 68764, 68766, 5133, 5143. **CMOS:** 27C16, 27C32, 27C64, MC6716. **EEPROM:** 5213, X2816A, 48016, I2816A, 5213H. **MPU (w/adaptor):** 8748, 8748H, 8749, 8749H, 8741, 8742, 8751, 8755.

7228	**Advanced Programmer**	**$ 549**
7128	**Standard Programmer**	**429**
7956	**Laboratory Gang Programmer**	**1099**
7956-SA	**Stand-Alone Gang Programmer**	**879**
GDX	**Driver Software**	**95**
481	**8748 Family Socket Adaptor**	**98**
511	**8751 Socket Adaptor**	**174**
755	**8755 Socket Adaptor**	**135**
CABLE	**RS-232 Cable (specify gender)**	**30**

HEXTRAN Universal HEX File Converter — Convert assembler output to other formats for downloading to development systems and target boards. Also useful for examining object file, changing load addresses, extracting parts of files. Converts to and from Intel, Motorola, MOS, RCA, Fairchild, Tektronix, TI, Binary and HEX/ASCII Dump formats. For CP/M, CP/M-86, MSDOS, PCDOS $250

Ask about UNIX.

68000 CROSS-ASSEMBLER — With exhaustive field testing completed, our 68000 assembler is available for immediate shipment. XMAC68K supports Motorola standard assembly language for the 68000 and 68010. Macros, cross-reference, structured assembly statements, instruction optimization and more. Linker and librarian included. Comprehensive, well-written manual.

To find out more, call us toll-free.

1-800-448-8500

(in the U.S. Except Alaska and Hawaii)

VISA and Mastercard accepted. All popular disc formats now available --please specify. Prices do not include shipping and handling -- call for exact quotes. OEM INQUIRIES INVITED.

*Trademark of Digital Research **Trademark of Microsoft

AVOCET SYSTEMS INC.™

Sales and Development:
10 Summer Street
P.O. Box 490, Dept. 185-PCT
Rockport, Maine 04856
(207) 236-9055 Telex: 467210 AVOCET CI

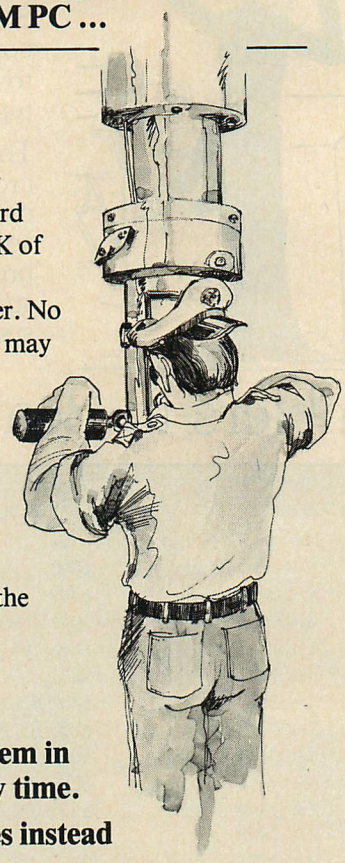
Corporate Offices:
804 South State Street
Dover, Delaware 19901

CIRCLE NO. 110 ON READER SERVICE CARD

Debugging Bugging You?

Torpedo program crashes and debugging delays with debugging dynamite for the IBM PC ...

UP PERISCOPE!



First, you install the hardware.

The hardware's a special memory board that fits in a PC expansion slot. Its 16K of write-protected memory contains Periscope's resident symbolic debugger. No runaway program, however berserk it may be, can touch this memory!

Then you UP PERISCOPE.

Use Periscope's push-button break-out switch to interrupt a running program ... even when the system's hung! Periscope supports Assembly, BASIC, C and Pascal. In addition to the usual debugging capabilities, some of Periscope's features are:

Stop your system in its tracks at any time.

Use symbol names instead of addresses.

Run a program on one monitor and debug on another.

Monitor your program's execution with Periscope's comprehensive breakpoints.

Debug memory-resident programs.

Put your time to better use.

The Periscope system is $295. It carries a 30-day money-back guarantee and includes the memory board, remote break-out switch, debugger software, 100-page manual, and quick-reference card. The memory board is warranted for one year. A demonstration disk is $5.00.

System requirements for Periscope are an IBM PC, XT or Compaq, PC-DOS, 64K RAM, 1 disk drive and an 80-column monitor. For MasterCard and Visa orders only, call 800/421-5300 (ext. R96) 24 hours a day. For additional information, call 404/256-3860 from 9 AM to 5 PM Eastern Time.

Get your programs up and running;

UP PERISCOPE!

Data Base Decisions / 14 Bonnie Lane /Atlanta, GA | 30328

CIRCLE NO. 215 ON READER SERVICE CARD

ginning of a file-transfer operation, the sender of the file sends this packet to the receiver to inform it about certain conditions that must be met. The first six data bytes are required. The rest are optional and will be ignored by older Kermit versions that do not know about them. New features and codes are always added to the end of the existing data-entry string to guarantee backward compatibility.

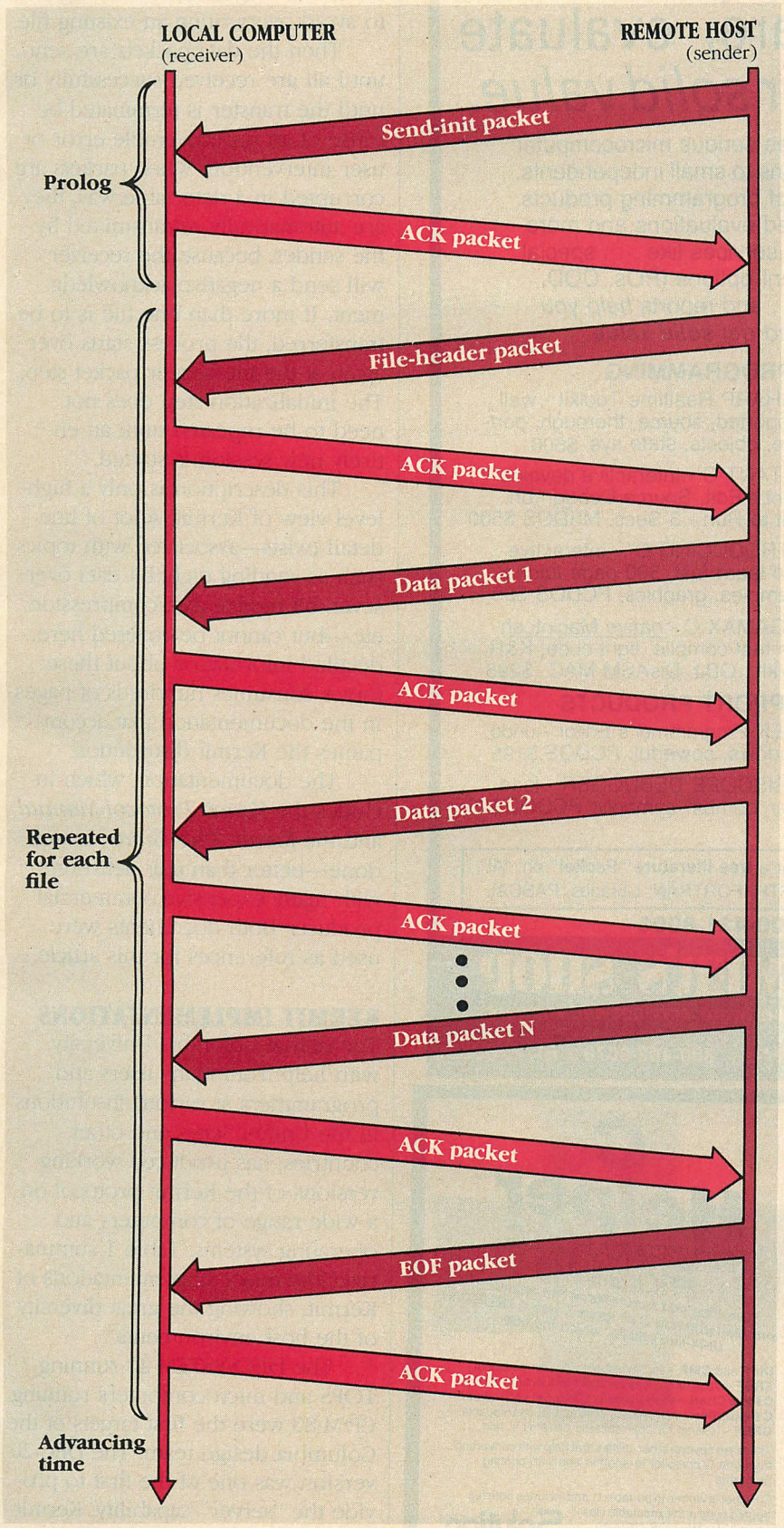
The capabilities (CAPAS) entry is unusual in several respects. It has no fixed length. If bit 0 in any byte of the string contains a 1, another byte follows. If that bit contains a 0, it is the last byte in the capabilities mask. A capability assigned to that position in the aggregate mask is supported if the bit is a 1 and is not supported if the bit is a 0.

A sample Kermit file transfer is depicted in a transaction diagram in figure 4. For simplicity, it is assumed to be a successful transfer. After the local and remote systems have agreed to transfer a file or a group of files, the sender, in this case the remote system, sends to the file receiver a send-init packet that contains the information just described. The receiver sends an acknowledge packet with similar information in its data field.

The minimum set of capabilities acceptable to both sender and receiver is used for the transfer. As an example, if one system can handle CRC block checking but the other cannot, a single-byte checksum will be used by default. Other Kermit features supported by some implementations but not others are handled in similar ways.

After the preliminary exchange is completed, the sender transmits one packet at a time and awaits an acknowledgment from the receiver. The first packet of a file transfer contains the file's name on the sending end. The receiver can acknowledge the packet and can optionally indicate in the data field the name by which it intends to store

FIGURE 4: *Transaction Diagram for a Kermit File Transfer*



LISP FOR THE IBM PERSONAL COMPUTER.

THE PREMIER LANGUAGE OF ARTIFICIAL INTELLIGENCE FOR YOUR IBM PC.

- **DATA TYPES**
  Lists and Symbols
  Unlimited Precision Integers
  Floating Point Numbers
  Character Strings
  Multidimensional Arrays
  Files
  Machine Language Code
- **MEMORY MANAGEMENT**
  Full Memory Space Supported
  Dynamic Allocation
  Compacting Garbage Collector
- **FUNCTION TYPES**
  EXPR/FEXPR/MACRO
  Machine Language Primitives
  Over 190 Primitive Functions
- **IO SUPPORT**
  Multiple Display Windows
  Cursor Control
  All Function Keys Supported
  Read and Splice Macros
  Disk Files
- **POWERFUL ERROR RECOVERY**
- **8087 SUPPORT**
- **COLOR GRAPHICS**
- **LISP LIBRARY**
  Structured Programming Macros
  Editor and Formatter
  Package Support
  Debugging Functions
  OBJ File Loader
- **RUNS UNDER PC-DOS 1.1 or 2.0**

IQLISP

5¼" Diskette and Manual _____ $175.00
Manual Only _____ $ 30.00

∫q *Integral Quality*

P.O. Box 31970
Seattle, Washington 98103-0070
(206) 527-2918

Washington State residents add sales tax.
VISA and MASTERCARD accepted.
Shipping included for prepaid orders.

CIRCLE NO. 243 ON READER SERVICE CARD

3,500 Programmers depend on us to find, compare, evaluate products and for *solid value.*

THE PROGRAMMER'S SHOP serves serious microcomputer programmers . . . from giant institutions to small independents. *Specializing* helps us provide 100s of programming products . . . technical literature . . . specialized evaluations and more to help you find and evaluate. Other services like . . . special formats . . . rush delivery . . . payment options (POs, COD, credit cards, etc.) . . . newsletters . . . and reports *help you save time, money, and frustration and get* ***solid value.***

ARTIFICIAL INTELLIGENCE

EXSYS - Expert System building tool. Full RAM, Probability, Why, Intriguing, serious. PCDOS $200

GC LISP - "COMMON LISP", Help, tutorial, co-routines, compiled functions, thorough. PCDOS $475

TLC LISP - "LISP-machine"-like, all RAM, classes, turtle graphics, 8087 for CP/M-86, PCDOS or MSDOS $235

Expert System front-ends for PROLOG: APES ($275), ES/P ($1895)

Other solid alternatives include: IQ LISP ($155), MuLISP-86 ($250), WALTZ LISP for CPM ($159), MicroPROLOG ($275), PROLOG-86 ($125), more.

C PROGRAMMING

C SHARP Realtime Toolkit - well supported, source, thorough, portable, objects, state sys. $600

INSTANT C - Interactive development - Edit, Source Debug, run. Edit to Run - 3 Secs. MSDOS $500

"INTRODUCING C" - Interactive C to learn fast. 500 page tutorial, examples, graphics. PCDOS $95

MEGAMAX C - native Macintosh has fast compile, tight code, K&R, toolkit, .OBJ, DisASM MAC $295

SUPPORT PRODUCTS

BRIEF Programmer's Editor - undo, windows, powerful. PCDOS $195

PERISCOPE DEBUGGER - load after "bombs", symbolic. PCDOS $295

Call for a Catalog, literature on any product or a **free literature "Packet"** on: "AI", BASIC, C, COBOL, Debuggers, Editors, FORTH, FORTRAN, Libraries, PASCAL

CALL TOLL FREE 800-421-8006

THE PROGRAMMER'S SHOP™

The programmer's complete source for software, services and answers

128-P Rockland Street, Hanover, MA 02339 In Mass.: **800-442-8070** or 617-826-7531

ARTIFICIAL INTELLIGENCE

Programming:

Learn Fast, Experiment

with the language chosen by JAPAN.

PROLOG-86™

is "Standard" with Tutorials, samples of *NATURAL LANGUAGE & EXPERT SYSTEM.*

Intro Prce: $125 for CPM-86, MSDOS.

Full Refund if not satisfied in first 30 days.

617-659-1571

Solution Systems™

33 -P Washington Street
Norwell, MA 02061

C Helper™

FIRST-AID FOR C PROGRAMS

Save time and frustration when analyzing and manipulating C programs. Use C HELPER's UNIX-like utilities which include:

DIFF and **CMP** – for "intelligent" file comparisons.
XREF – cross references variables by function and line.
C Flow Chart – shows what functions call each other.
C Beautifier – make source more regular and readable.
GREP – search for sophisticated patterns in text.

There are several other utilities that help with converting from one C compiler to another and with printing programs.

C Helper is written in portable C and includes both full source code and executable files for $135 for MS-DOS, CPM-80 or CPM-86. Use VISA, Master Card or COD.

Call: **617-659-1571**

Solution Systems™

33 -P Washington Street
Norwell, MA 02061

CIRCLE NO. 160 ON READER SERVICE CARD

KERMIT

the file on the receiving end. This may be done by some systems if a name is changed to make it legal or to avoid overwriting an existing file.

Then the data packets are sent until all are received successfully or until the transfer is terminated because of an unrecoverable error or user intervention. When packets are corrupted in a detectable way, they are automatically retransmitted by the sender, because the receiver will send a negative acknowledgment. If more than one file is to be transferred, the process starts over again at the file-header packet step. The initialization step does not need to be repeated until an entirely new session is started.

This description is only a high-level view of Kermit. A lot of fine detail exists—associated with topics such as sending eight-bit data over seven-bit media, data compression, etc.—but cannot be covered here; detailed information about these topics consumes hundreds of pages in the documentation that accompanies the Kermit distribution.

The documentation, which includes the *Kermit Protocol Manual* and the *Kermit User Guide*, is well done—better than that delivered with many expensive commercial products. Both documents were used as references for this article.

KERMIT IMPLEMENTATIONS

The staff at Columbia University, with help from many users and programmers at various institutions in the United States and other countries, has produced working versions of the Kermit protocol on a wide range of computers and operating systems. Table 1 summarizes the major implementations of Kermit, showing the great diversity of the host environments.

The DECSYSTEM-20 running TOPS and microcomputers running CP/M-80 were the first targets of the Columbia design team. The DEC-20 version was one of the first to provide the "server" capability. Kermit


What can be better than a "10"?

NEW FEATURES

(Free update for our early customers!)

- Edit & Load multiple memory resident files.
- Complete 8087 assembler mnemonics.
- High level 8087 support.
  Full range transcendentals (tan, sin, cos, arctan, logs and exponentials)
  Data type conversion and I/O formatting.
- High level interrupt support.
  Execute Forth words from within machine code primitives.
- 80186 Assembler extensions for Tandy 2000, etc.
- Video/Graphics interface for Data General Desktop Model 10

HS/FORTH

- Fully Optimized & Tested for:
  IBM-PC IBM-XT IBM-JR
  COMPAQ EAGLE-PC-2
  TANDY 2000 CORONA
  LEADING EDGE
  (Identical version runs on almost all MSDOS compatibles!)
- Graphics & Text
  (including windowed scrolling)
- Music - foreground and background
  includes multi-tasking example
- Includes Forth-79 and Forth-83
- File and/or Screen interfaces
- Segment Management Support
- Full megabyte - programs or data
- Complete Assembler
  (interactive, easy to use & learn)
- Compare
  BYTE Sieve Benchmark jan 83
  HS/FORTH 47 sec BASIC 2000 sec
  w/AUTO-OPT 9 sec Assembler 5 sec
  other Forths (mostly 64k) 70-140 sec

FASTEST FORTH SYSTEM AVAILABLE.

TWICE AS FAST AS OTHER FULL MEGABYTE FORTHS!

(TEN TIMES FASTER WHEN USING AUTO-OPT!)

HS/FORTH, complete system only: $250.

VISA Visa Mastercard

Add $10. shipping and handling

HARVARD SOFTWORKS

PO Box 2579
Springfield, OH 45501
(513) 390-2087

CIRCLE NO. 222 ON READER SERVICE CARD

TABLE 1: *Kermit Implementations*

COMPUTER	OPERATING SYSTEM	LANGUAGE
DECSYSTEM-10	TOPS-10	MACRO-10
DECSYSTEM-20	TOPS-20	MACRO-20
IBM 370 Series	VM/CMS, MTS	IBM Assembler, Pascal
CDC Cyber 170	NOS	FORTRAN-77
Univac 1100	EXEC	EXEC Assembler
Honeywell	MULTICS	PL/1
PRIME	PRIMOS	PL/1
VAX-11-series	VMS	BLISS-32, MACRO-32
	UNIX	C
PDP-11	RT-11	OMSI Pascal
	RSX-11, RSTS/E	MACRO-11
	UNIX	C
Sun	UNIX	C
Data General	AOS	Ratfor
HP3000, Univac, etc.	Software Tools	Ratfor
Terak, HP-98xx	UCSD p-System	UCSD Pascal, Macro-11
8080/8085/Z80	CP/M-80	Digital Research ASM
8086/8088	MS-DOS, PC-DOS	Microsoft MASM
	CP/M-86	Digital Research ASM86
Apple II (6502)	Apple DOS	DEC-10/20 Cross-assembler
Atari Home Computers	Atari DOS	Action!

is available for machines running UNIX (PDP, VAX, Sun) and for a range of personal computers. New implementations are being written continually, and several versions run on the IBM-PC family of computers as well as on many of the compatibles that run either MS-DOS or PC-DOS.

After the preliminary exchange is completed, the sender transmits one data packet at a time and then awaits an acknowledgment from the receiver.

Much of Kermit's usefulness derives from its extensive set of commands for both local and remote operation. Table 2 is a condensation of the Kermit command descriptions. The options to the SET command are described in table 3. The minimum configuration of Kermit has at least the SEND and RECEIVE capabilities and often includes the CONNECT terminal emulation. The MS-DOS version (KERMIT-86) has these commands plus GET, the program management commands, a STATUS command (instead of SHOW), and subsets of the REMOTE command and SET options. It also has several new SET options (see table 4).

USER EXPERIENCE

Kermit is fussy about parity, because it is designed to use eight data bits if they are available or seven data bits and the quoting mechanism if normal parity cannot be disabled. If the parity settings are not right on both the local and the remote systems, Kermit will display error messages. Some experimentation may be required to find the correct settings.

Kermit is powerful and flexible, but may be a bit overwhelming for new users. It is necessary to learn a layer of operation and control beyond that of the base program if the Kermit component of a multipurpose communications product, such as Telios, is being used. The command syntax and operation, however, should be familiar across

Two 10s

The New 10-N-10 —More Hard Disk Innovation from XCOMP

You know XCOMP for advanced disk drive technology.

Once again, XCOMP introduces the new standard of hard disk design. It's portable.

The 10-N-10 features two removable 10 megabyte hard disk cartridges that combine Winchester reliability with portability for the ultimate solution to cost-effective interactive data storage, backup and archiving.

Two Removable 10Mb DMA Hard Disk Cartridges

- Winchester reliability
- Unlimited storage and backup
- Boots like an IBM XT
- 5¼" cartridge— ANSI standard
- 10,000 hrs. MTBF
- On-board microprocessor firmware
- Multiple operating systems

XCOMP

- One year warranty
- Networkable with X-Net LAN

Depend on XCOMP: Advanced Technology, Affordable Prices

XCOMP has been rated number one for performance and price.

In addition to the new 10-N-10, XCOMP now offers the X-Combo Series 10, 20 or 30Mb fixed hard disk with one DMA 10Mb removable cartridge.

For information call 619-573-0077

CIRCLE NO. 197 ON READER SERVICE CARD

4223 PONDEROSA AVENUE SAN DIEGO, CALIFORNIA 92123 (619) 573-0077 TELEX: 182786

XCOMP DISTRIBUTORS: Smartware 415/974-1500 FA 212/507-1444 Ecom (Ontario, Canada 416/477-1140
Ferrari (V.A. and U.K.) 703/821-3090 Greymatrix (South Africa) 4-28493 SA PC Distrib. 312/298-1400

a range of products that will soon incorporate Kermit.

I did not have access to a system that runs Kermit in the Server mode so I was unable to test those features. The rest of the features of Kermit worked, with practice, as described in the documentation.

WHO'S USING KERMIT?

Initially, the user base for Kermit was people involved in noncommercial applications, such as university faculty, staff, and students, as well as government agencies, which often work closely with universities.

Commercial users are now getting into the act. The Genasys Telios program has used Kermit for about a year, and other manufacturers, such as Microstuf (Crosstalk XVI), talk of adding Kermit. Columbia University encourages suppliers to add Kermit to their offerings—as long as doing so does not significantly increase in the retail price.

Kermit is distributed on nine-track magnetic tape in several formats (see table 5). The complete distribution on tape costs $100, and printed documents are $5 each. The tape distribution includes one hard copy of each manual in addition to the text on tape, mostly in the SCRIBE source format. The product can be ordered from:

Kermit Distribution
Columbia University Center for Computing Activities
7th Floor, Watson Laboratory
612 West 115th Street
New York, NY 10025

Specify in a letter exactly which items are being purchased. There is no floppy-disk support of any kind. Microcomputer versions must be bootstrapped from a host that has magnetic-tape facilities or copied from a microcomputer system that already has Kermit in floppy format. The programs and documentation may be distributed freely to anyone, although the developers ask that Kermit be used only for peaceful and benevolent purposes.

TABLE 2: *Kermit Commands*

BASIC COMMANDS	
SEND	Send one file or a group of files
RECEIVE	Expect file(s) to arrive
GET	Request file(s) from a remote Kermit
PROGRAM MANAGEMENT COMMANDS	
EXIT	Clean up and leave Kermit
QUIT	Leave Kermit without cleaning up
PUSH	Preserve the current environment and enter the system command processor
TAKE	Read and execute Kermit program commands from a file
LOG	Specify a log file
TERMINAL EMULATION COMMANDS	
CONNECT	Emulate a dumb terminal at the local Kermit point (has "escape" for executing local system commands)
SPECIAL USER-MODE COMMANDS (valid only when talking to a "server")	
BYE	Log out of a session with the server Kermit
FINISH	Leave remote server level but retain Kermit-to-Kermit connection
COMMANDS REQUIRING OBJECTS	
PREFIXES:	
REMOTE	Ask for a service at the remote Kermit point
LOCAL	Perform a service locally
COMMANDS:	
LOGIN	Create an identity for a job or session
LOGOUT	Terminate a job or session started by LOGIN
COPY	Copy a file to another file
CWD	Change working directory
DIRECTORY	List names, etc., of file in current directory
DELETE	Delete file(s)
ERASE	Synonym for DELETE
KERMIT	Send a remote command in the remote's own syntax
RENAME	Change the name of a file
TYPE	Display the contents of file(s)
SPACE	Display space remaining in current or specified directory
SUBMIT	Submit file(s) for background (batch) processing
PRINT	Print specified file(s) on a local printer
MOUNT	Request mount of a removable storage medium
WHO	Show who is logged in in a timesharing environment
MAIL	Send electronic mail
MESSAGE	Send a terminal message
HELP	Give brief information on use of Kermit
SET	Set various Kermit parameters
SHOW	Display summary of Kermit parameter settings
STATISTICS	Display data on most recent file transfer
HOST	Pass the given command to the remote or local host for execution in its own command language
LOGGING	Open/close a remote transaction or debugging log

TABLE 3: *Kermit SET Command Parameters*

BLOCK-CHECK	Select 1- or 2-char checksum, or 3-char CRC
DEBUGGING	Turn on log or display of debugging data
DELAY	Start-up delay a remote Kermit allows before sending a Send-int packet
DUPLEX	Select full- or half-duplex operation
EIGHT-BIT-PREFIXING	Turn on eighth-bit prefixing
END-OF-LINE	Specify line terminator character for packets
ESCAPE	Specify "escape" character for terminal emulation
FILE	Tell Kermit about a file's attributes (text/binary/etc.)
FLOW-CONTROL	Set XON/XOFF, DTR/CTS, or other flow control mechanism on or off (for full-duplex only)
HANDSHAKE	Specify line-turn-around signal or other "agreements"
LINE	Specify line or device designator for the connection
LOG	Specify a local transaction-log file
MARKER	Specify the start-of-packet marker (default = SOH)
PACKET-LENGTH	Specify maximum packet length (96 or less)
PADDING	Pad character and number to be sent before packet (usually none required)
PARITY	Specify NONE, ODD, EVEN, MARK, or SPACE
PAUSE	Delay needed before sending a packet after receipt of a previous packet (usually 0)
PREFIX	Change default prefix
PROMPT	Set system's Kermit prompt
REPEAT-COUNT-PROCESSING	Change the default for repeat-count processing
RETRY	Set maximum times to attempt to send or receive a packet before giving up
TIMEOUT	Set maximum period to wait for a given packet attempt

TABLE 4: *Functions Included in KERMIT-86*

BACKARROW	Select "backspace" or "delete" for the backarrow key
BAUD	Select 300-9,600 baud transmission rate
BELL	Enable/disable the terminal bell
FILE-WARNING	Warn user of file naming conflicts
HEATH-19	Interpret H19 screen control codes
IBM	Set parameters for communications with IBM mainframe hosts
INCOMPLETE	Set incomplete file treatment (KEEP or DISCARD)
LOCAL-ECHO	Select remote or local echoing
PORT	Set or change port for use by CONNECT

TABLE 5: *Available Nine-track Formats*

SYSTEM	TAPE FORMAT	DENSITIES
TOPS-10	BACKUP/Interchange, Unlabeled	800, 1600
TOPS-20	DUMPER, Unlabeled	800, 1600
IBM VM/CMS	EBCDIC, CMS Format	1600, 6250
	EBCDIC, OS Standard Label	1600, 6250
Other	ASCII, ANSI Label, Format "D"	800, 1600

Pascal and C Programmers

Your programs can now compile the

FirsTime™

FirsTime is an intelligent editor that knows the rules of the language being programmed. It checks your statements as you enter them, and if it spots a mistake, it identifies it. *FirsTime* then positions the cursor over the error so you can correct it easily. *FirsTime will identify all syntax errors, undefined variables, and even statements with mismatched variable types.* In fact, any program developed with the *FirsTime* editor will compile on the first try.

More than a syntax checker!
FirsTime has many unique features found in no other editor. These powerful capabilities include a zoom command that allows you to examine the structure of your program, automatic program formatting, and block transforms.

If you wish, you can work even faster by automatically generating program structures with a single key-stroke. This feature is especially useful to those learning a new language, or to those who often switch between different languages.

Other Features: Full screen editing, horizontal scrolling, function key menus, help screens, inserts, deletes, appends, searches, and global replacing.

Programmers enjoy using *FirsTime.* It allows them to concentrate on program logic without having to worry about coding details. Debugging is reduced dramatically, and deadlines are more easily met.

FirsTime for PASCAL	$245
FirsTime for C	$295
Microsoft PASCAL Compiler	$245
Microsoft C Compiler	$395
Demonstration disk	$25

Get an extra **$100 off** the compiler when it is purchased with ***FirsTime.***
(N.J. residents please add 6% sales tax.)

Spruce
Technology Corporation
110 Whispering Pines Drive
Lincroft, N.J. 07738
(201) 741-8188 or (201) 663-0063

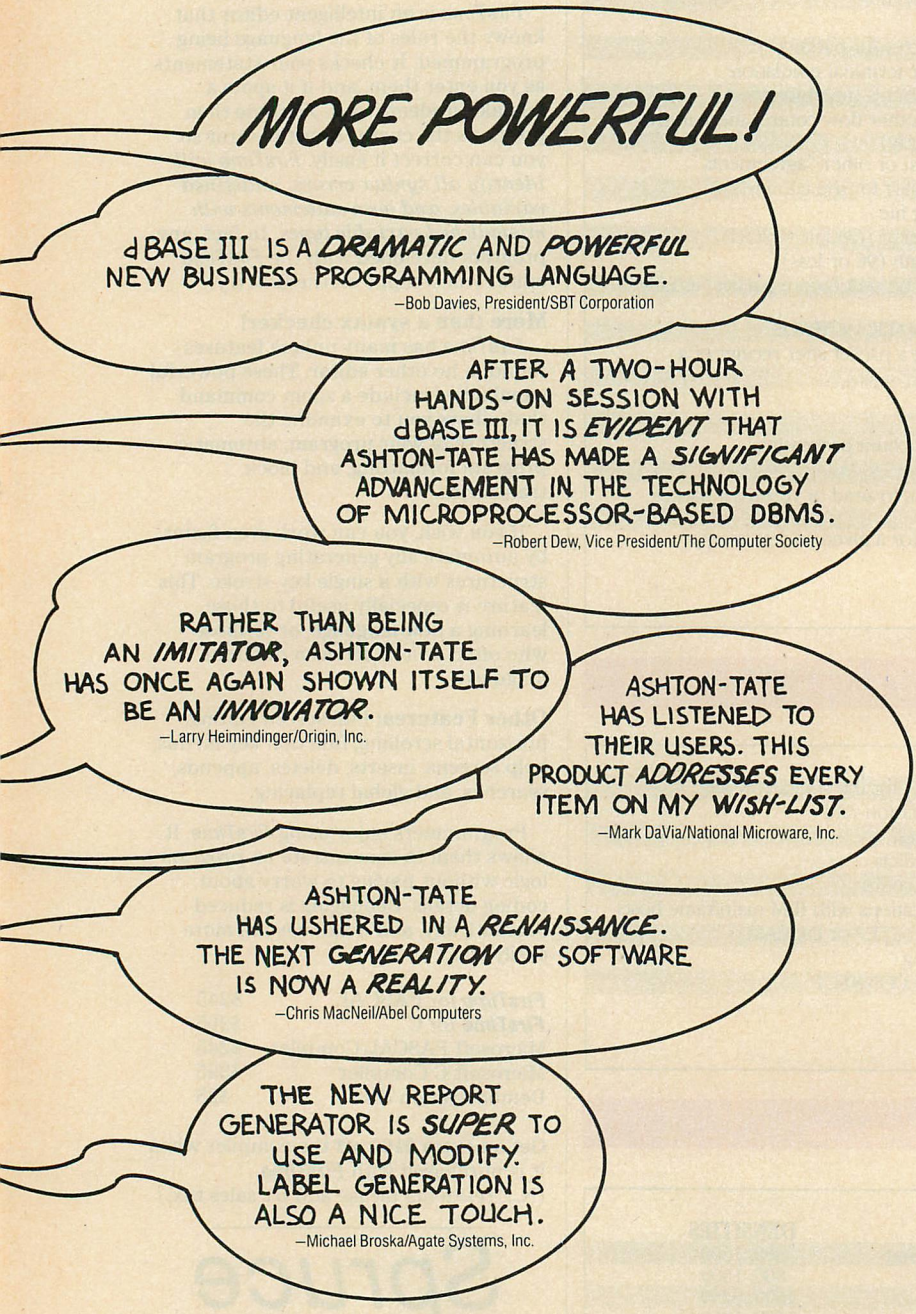
Dealer enquiries welcome. Custom versions for computer manufacturers and language developers are available.

FirstTime is a trademark of Spruce Technology Corporation.

MasterCard VISA

CIRCLE NO. 132 ON READER SERVICE CARD

dBASE III v



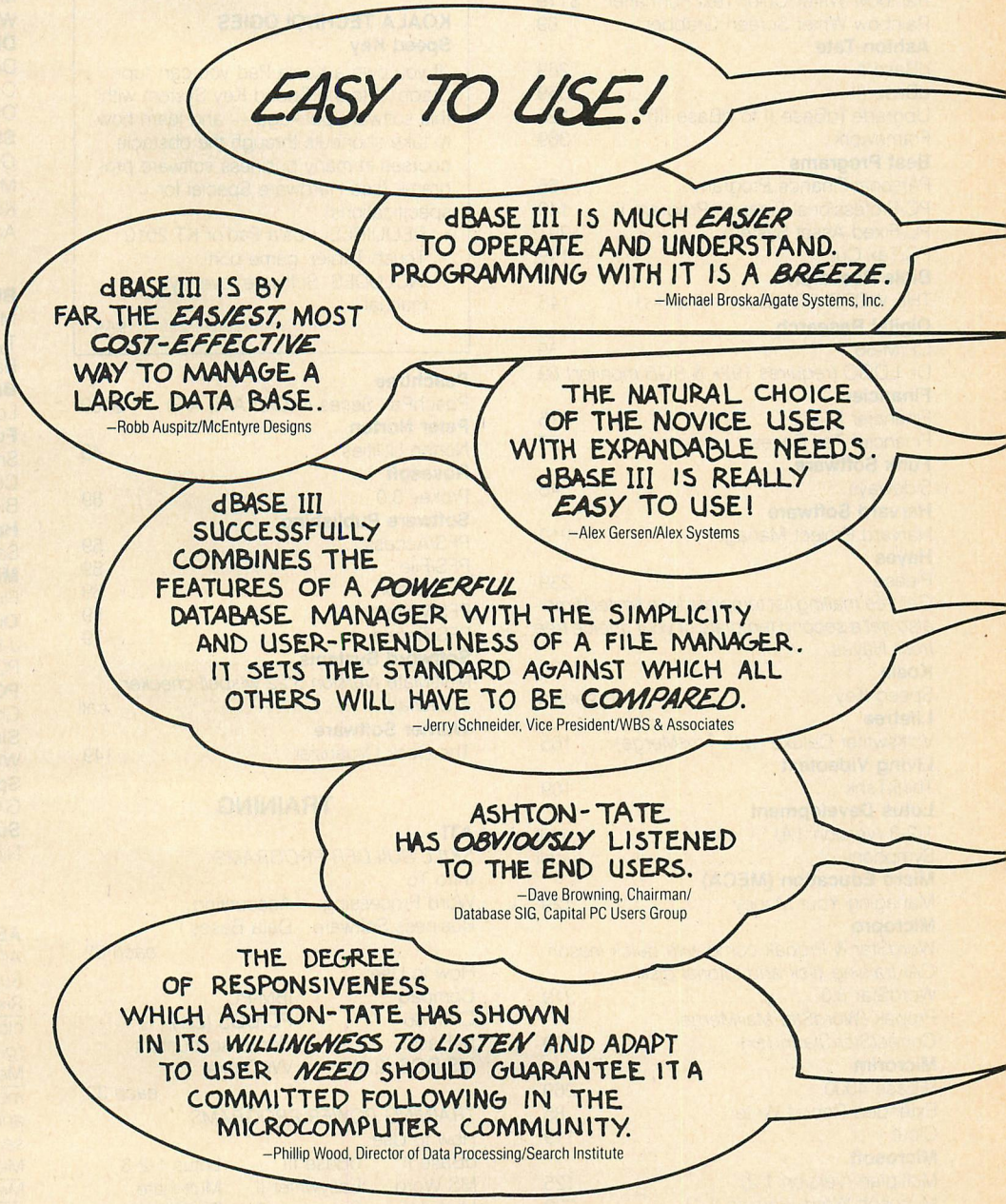
dBASE III™ is the powerful and easy-to-use relational database management system you've been waiting for. You can use it without hesitation whether you're a beginner or an expert.

The big winner in the easy-to-use vs. more powerful controversy is you.

If you want to know all about dBASE III, come to your Ashton-Tate software dealer for a free demonstration. For more information call (800) 437-4329 ext. 2330 or in Colorado call (303) 799-4900 ext. 2330.

dBASE III and Ashton-Tate are trademarks of Ashton-Tate. © Ashton-Tate 1984. All rights reserved.

s. dBASE III



dBASE III

Software from ASHTON·TATE™

CIRCLE NO. 300 ON READER SERVICE CARD

Pssst. It's time to

SOFTWARE

Aptec *(for color Prism Printers)*
Rainbow Writer Color Text Formatter . . $119.
Rainbow Writer Screen Grabber . . . . . 69.
Ashton-Tate
dBase II . . . . . 269.
dBase III . . . . . 369.
Upgrade (dBase II to dBase III) . . . . . 125.
Framework . . . . . 369.
Best Programs
Personal Finance Program . . . . . 65.
PC/Professional Finance Program II . . 149.
PC/Fixed Asset System . . . . . 297.
PC/Tax Cut . . . . . 149.
Bible Research
THE WORD *(KJV Bible - 7 disks)* . . . . . 145.
Digital Research
CP/M-86 . . . . . 39.
Dr. LOGO *(requires 192k & RGB monitor)* 69.
Financier
Financier II . . . . . 115.
Financier Tax Series . . . . . 97.
Funk Software
Sideways . . . . . 45.
Harvard Software
Harvard Project Manager . . . . . 219.
Hayes
Please . . . . . 239.
Get free mailing list template for a limited time - also get a second template of your choice free from Hayes.
Koala
Speed Key . . . . . see special
Lifetree
Volkswriter Deluxe *(with TextMerge)* . . . 165.
Living Videotext
ThinkTank . . . . . 109.
Lotus Development
1-2-3 *(version 1A)* . . . . . call
Symphony . . . . . call
Micro Education (MECA)
Managing Your Money . . . . . 129.
Micropro
WordStar & Propak come with quick lesson CAI training disk and tutorial disk
WordStar 3.3 . . . . . 219.
Propak *(WordStar/MailMerge/ CorrectStar/StarIndex)* . . . . . 279.
Microrim
R:base 4000 . . . . . 269.
Extended Report Writer . . . . . 85.
Clout . . . . . 119.
Microsoft
Multiplan *(version 1.2)* . . . . . 125.
Microsoft Word *(version 1.1)* . . . . . 239.
Microsoft Word with mouse *(version 1.1)* 289.
Microsoft Project . . . . . 155.
Microsoft Chart . . . . . 155.
Microstuf
Crosstalk XVI . . . . . 99.
Infoscope . . . . . 149.
Transporter *(includes Crosstalk)* . . . . . 169.
PCsoftware
PCcrayon II *(new release)* . . . . . 39.
Executive Picture Show . . . . . 139.
CREATABASE . . . . . 47.

PC Connection Software Special
through November 30, 1984

KOALA TECHNOLOGIES
Speed Key

If you own a Koala Pad you can "upgrade" it to the Speed Key System with this software package — and learn how to take shortcuts through the obstacle courses in many business software programs (see Hardware Special for specifications).

- REQUIRES: Koala Pad or KT 2010 Touch Tablet, game port
- INCLUDES: Software, overlays, manual

. . . . . $55.

Peachtree
PeachPak Series 4 (G/L, A/R, A/P) . . . . $189.
Peter Norton
Norton Utilities . . . . . 49.
Rosesoft
Prokey 3.0 . . . . . 89.
Software Publishing
PFS/Access . . . . . 59.
PFS/File . . . . . 89.
PFS/Graph . . . . . 89.
PFS/Write . . . . . 89.
PFS/Report . . . . . 79.
Softword Systems
MultiMate *(version 3.22 w/spell checker & tutorial)* . . . . . call
Warner Software
The Desk Organizer . . . . . 149.

TRAINING

ATI
SKILL BUILDER PROGRAMS
Intro To:

Word Processing	Accounting
Business Software	Data Bases

. . . . . *each* 32.

How to Use:

Compaq	IBM-PC
CPM-86	PC-DOS (2.1)
M-Basic	Home Accountant
MS-DOS (2.0)	VW Dluxe

. . . . . *each* 32.

TRAINING POWER PROGRAMS
How to Use:

dBase II	dBase III	Lotus 1-2-3
MS Word	Easywriter II	Multimate
Multiplan	Supercalc 3	Framework
Symphony	Wordstar	TK!Solver

Peachtree *(specify A/R,A/P,G/L, sales invoice, inventory)* . . . . . *each* 49.
Individual Software
The Instructor . . . . . 35.
Professor DOS . . . . . 47.
Tutorial Set *(both items above)* . . . . . 75.
Professor Pixel . . . . . 47.
Typing Instructor . . . . . 39.
Scarborough Systems (was Lightning)
Master Type . . . . . 39.

EDUCATIONAL

Davidson
Speed Reader II *(high school & college)* 49.
Math Blaster *(grades 1-6)* . . . . . 35.
Word Attack *(grades 4-12)* . . . . . 35.
Digital Research
Diagnostic Test (PSAT) . . . . . 14.
OwlCat SAT *(15 hours)* . . . . . 63.
OwlCat SAT *(60 hours)* . . . . . 169.
Stone *(requires graphics board)*
Great graphics and sound
My Letters,Numbers,Words *(ages 1 to 5)* 29.
Kids Stuff *(ages 3 to 8)* . . . . . 29.
Across the U.S.A. *(ages 5 & up)* . . . . . 22.

GAMES

Blue Chip
Millionaire . . . . . 39.
Tycoon . . . . . 39.
Baron . . . . . 39.
Broderbund
Lode Runner . . . . . 25.
Funtastic
Snack Attack II *(a favorite)* . . . . . 27.
Cosmic Crusader *(as good as above)* . . 27.
Big Top *(climb to new levels)* . . . . . 29.
Hayden Software
Sargon III . . . . . 35.
Microsoft
Flight Simulator . . . . . 35.
Orion
J-Bird *(you'll never sleep)* . . . . . 29.
PC-Man . . . . . 25.
PCsoftware
Championship Blackjack . . . . . 23.
Sir-Tech
Wizardry . . . . . 42.
Spectrum Holobyte
GATO . . . . . 27.
Sublogic
Night Mission Pinball . . . . . 29.

HARDWARE

AST Research *(For IBM-PC or XT)*
All AST Boards come with SuperDrive, SuperSpool, and one year warranty.
SixPakPlus 64k upgradeable to 384k, with clock calendar, serial and parallel ports *(game port optional)* . . . . . 269.
MegaPlus II 64k upgradeable to 256k (or more with MegaPak) with clock calendar and serial port *(parallel, game, or second serial port optional)* . . . . . 269.
MegaPak 128k *(not upgradeable)* . . . . . call
MegaPak 256k . . . . . call
I/O Plus II with clock calendar and serial port *(parallel, game, or second serial port optional)* . . . . . 129.
Parallel, Game, or second Serial Port *for any AST board (specify board)* . . . . . 39.
AST-5251 . . . . . 559.
AST-3780 . . . . . 649.
MonographPlus with clock calendar, serial & parallel ports . . . . . 429.
Amdek
Video 300G monitor *(green)* . . . . . 139.
Video 300A monitor *(amber)* . . . . . 149.

* DEFECTIVE SOFTWARE REPLACED IMMEDIATELY. DEFECTIVE HARDWARE REPLACED OR REPAIRED AT OUR DISCRETION. SOME ITEMS HAVE WARRANTIES UP TO FIVE YEARS.
© COPYRIGHT MICRO CONNECTION, INC. 1984. ALL ITEMS SUBJECT TO AVAILABILITY. PRICES SUBJECT TO CHANGE WITHOUT NOTICE. IBM IS A REGISTERED TRADEMARK OF IBM CORP. MICRO CONNECTION IS A TRADEMARK OF MICRO CONNECTION, INC. PC CONNECTION IS A REGISTERED TRADEMARK.

call your connection.

Video 310A monitor *(amber)* ..... $179.

Compucable
Plastic Keyboard & Drive Cover Set.... 17.
IBM Mono Screen Enhancement..... 17.

Curtis
STANDS
PC Pedestal *(for IBM Mono or Color)*... 39.
PGS or Quadchrome Adapter for above.. 9.
Low Profile Tilt and Swivel Pedestal.... 39.
System Stand ..... 21.

CABLES
Extension Cables for IBM Mono Display 39.
Keyboard Extension Cable *(3 to 9 feet)* 29.
AC Plug Adapter *(any monitor to your PC)* 8.

SURGE SUPPRESSORS - NEW
Diamond *(similar to EPD Lemon)* ..... 39.
Emerald *(similar to EPD Lime)*..... 49.
Sapphire *(similar to EPD Peach)*..... 59.
Ruby *(similar to EPD Orange)* ..... 69.

Epson
RX-80 with GRAFTRAX-Plus..... call
FX-80 with GRAFTRAX-Plus..... call
RX-100 with GRAFTRAX-Plus..... call
FX-100 with GRAFTRAX-Plus..... call
LQ-1500 *(letter quality dot matrix)*..... call
Printer to IBM Cable (specify printer)... 32.

Hayes
Smartmodem 300..... 209.
Smartmodem 1200..... 489.
Smartmodem 1200B *(w/Smartcom II)* 409.
Smartcom II ..... 99.

Hercules Computer
Hercules Graphics Card *(parallel port)* 339.
Hercules Color Card *(parallel port)*.... 179.

key tronic
Deluxe keyboard (KB 5151)..... call

Koala
Koala Touch Tablet *with software (connects to game port)* ..... 89.
Speed Key System..... see special

Kraft
Joystick..... 39.

Maynard Electronics
Floppy Drive Controller ..... 135.
Internal Hard Disk (10 Meg),WS-1 Controller & ROM for PC mother board ..... 879.
Internal Hard Disk (10 Meg) WS-2 Controller & ROM for PC Mother Board..... 1079.

Mouse Systems
PC Mouse (w/software & desk pad)... 149.

NEC
Spinwriter 3550 *(IBM-PC compatible)* 1499.
Spinwriter 2050 *(3550's little brother)*.. 789.

Orchid Technologies
All Orchid Boards come with PCnet Drive (Ram disk). PCnet spool (print spooling), disk caching & partitioning.

Blossom 64k upgradeable to 384k, with clock calendar, serial and parallel ports ..... 239.

PCnet Daughter Board (piggybacks to Blossom) with version 2.4 networking software ..... call

PC Connection Hardware Special
through November 30, 1984

KOALA TECHNOLOGIES
Speed Key System

- Simplifies the use of Lotus 1-2-3, Wordstar, Dbase II, Multiplan, and others.
- Works like a mouse to move cursor quickly and efficiently, but doesn't monopolize desk space or crowd screen with menus.
- Use or customize preconfigured overlays or create own to meet individual needs.
- REQUIRES: Game port.
- INCLUDES: KT 2010 Touch Tablet, software, overlays, manual ..... $109.

OUR POLICY

- We accept VISA and MASTERCARD.
- No surcharge added for charge cards.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order.
- No sales tax.
- All shipments insured; no additional charge.
- Allow 1 wk for personal & company checks to clear.
- COD max. $1000. Cash or certified check.
- 120 day guarantee on all products.*
- To order, call us anytime Monday thru Friday 9:00 to 9:00, or Saturday 9:00 to 5:30. You can call our business offices at 603/446-3383 Monday thru Friday 9:00 to 5:30.

SHIPPING

Continental US: For monitors, printers, and drives, add 2% to all orders. For all other items, add $2 per order for UPS surface, $3 per order for UPS 2nd-Day-Air. We particularly recommend 2nd-Day-Air if you live west of the Mississippi or south of Virginia. In most cases it will only cost $1 more and will save you up to four days on delivery time. **Outside Continental US:** We add freight charges to credit card purchases. For prepayment, call 603/446-3383 for information.

1-800/243-8088

PC Connection 315T
6 Mill St., Marlow, NH 03456
603/446-3383

For the IBM-PC *Exclusively.*

CIRCLE NO. 182 ON READER SERVICE CARD

Plantronics/Frederick
COLORPLUS *(with Color Magic)*..... call

Princeton Graphics
HX-12 RGB monitor *(690 x 240)* ..... call
SR-12 RGB monitor *(690 x 480)* ..... call
Scan Doubler Board (for SR-12) ..... call
MAX-12 Amber monochrome monitor .. call

Quadram
New Expanded Quadboard 64k expandable to 384k, with clock calendar, parallel, serial & game port, I/O bracket, and Quadmaster software ..... $269.
Microfazer Printer Buffer (parallel) w/copy MP 64 (64k) *upgradeable to 512k* .... 197.
Quadcolor I ..... 197.

SMA (Systems Management)
PC-Documate Keyboard Templates *available for:*

DOS/Basic 1.1	Supercalc 3
DOS/Basic 2.0-2.1	Wordstar
Lotus 1-2-3	Turbo Pascal
Symphony	WordPerfect
Multiplan (IBM)	dBase II
Multiplan (Microsoft)	dBase III
Peachtext 5000	Framework
Easywriter II	Multimate

Volkswriter Deluxe ..... *each* 12.

TG
Joystick..... 45.

DRIVES

All drives are completely pre-tested. Specify Drive A or Drive B for your PC. Comes with complete step by step installation instructions. Drives are 320k/360k.

Tandon
TM 100-2 (5¼") *full-height drive (DS,DD)* 185.

TEAC
FD-55B (5¼") *half-height drive (DS,DD)* 159.
Free 'y' cable & bracket with each pair.

MEMORY

Memory prices are coming down.
64k Memory Upgrade Set for IBM-PC or XT system board ..... 55.
64k Memory Upgrade Set for any memory board *specify make of board*..... 55.
Install memory upgrades & run diagnostics *at time of board purchase only* ..... 10.

DISKS

Verbatim *(with 5 year guarantee)*
Datalife Disks SS/DD *plastic box of 10* 23.
Datalife Disks DS/DD *plastic box of 10* 33.
Disk Drive Analyzer ..... 22.
Flip Sort *(holds 75 disks)* ..... 19.

INFORMATION SERVICES

Compuserve
Compuserve Information Service *(includes subscription, manual, 5 hours of connect time, monthly publications)*.... 25.

Source Telecomputing
The Source *(subscription & manual)* ... 29.

PC CONNECTION®


AT&T
AT&T
AT&T

AT&T AND IBM MAKE GREAT COMPUTERS

CIA IMPROVES THEM

WE TAKE OVER WHERE THEY LEAVE OFF

With a full line of internal and external hard disk drives in a wide range of storage capacities to suit your needs. As well as a newly introduced 3.3 megabyte floppy disk subsystem. All designed to provide fast, reliable storage for the AT&T PC, IBM PC and compatibles. Convert your IBM PC or compatible into an XT with our subsystems—all at the lowest prices anywhere.

10 MB Hard Disk Subsystem
Internal $ 885.00
External $1,265.00

10 MB Hard Disk Subsystem with 3.3 MB Floppy Disk Drive
External $1,995.00

20 and 40 MB Hard Disk Subsystems, internal or external mounts, with or without 3.3 MB Floppy Disk Drive also available.

WE GIVE REAL MEANING TO THE WORDS "VALUE ADDED"

We don't stop at providing solutions to your mass storage problems, CIA can solve all your business computing needs. As an approved AT&T Value Added Reseller with years of experience in turnkey systems, CIA brings you the full line of AT&T computers—from the PC 6300 running all the popular IBM compatible software under MS-DOS,* to the 3B family of UNIX* based multi-user Computer Systems with customized software to meet your needs. We also have the PC 6300 in a multi-user, multi-tasking system running XENIX* and MS-DOS.

Before you spend more, call the source for all your business computing solutions.

CIA

Computer Integration Associates
450 E. Kennedy Blvd.
Lakewood, NJ 08701
(201) 370-3900

CIRCLE NO. 208 ON READER SERVICE CARD

*MS-DOS is a trademark of MicroSoft
UNIX is a trademark of Bell Laboratories
XENIX is a trademark of MicroSoft

Telios

AUGIE HANSEN

Among the many commercial communications packages available for microcomputers, Telios was one of the first to incorporate the Kermit file transfer protocol. That, however, is not its only claim to fame. Telios, from the Genasys Corporation, offers several other capabilities that microcomputer communications users have come to expect, such as data capture to disk file and to a printer, XMODEM file transfers, and command file execution.

Telios requires a minimum of 96KB RAM, at least one single- or double-sided diskette drive, and an 80-column monochrome or color monitor. Telios will work with any version of PC-DOS beginning with 1.1. Additionally, either a built-in modem or a serial communications port cabled to an external modem is required for its use.

Provision is made for a PC running Telios to be wired directly to a host. A maximum transmission rate of 9,600 baud may be used. Such a connection requires a "null-modem" cable, which is described in figure 1. Simpler but less effective ways can be used to wire the null-modem, but they limit the amount of available control information that can be exchanged. The null-modem cable, as is suggested by its name, eliminates the need for real modems or data sets at both ends of the physical link, because line conditioning is not necessary over short, direct connections.

Telios was one of the first communications packages available for microcomputers to use the Kermit file transfer protocol.

After displaying its banner screen for a brief time upon start-up, Telios displays a dialing directory screen (photo 1) that has space for 10 entries at a time. A selection may be made by pressing a function key, which invokes the related command file using the DO command to dial the desired computer and begin a session. The number of directory entries is limited only by disk space and file directory entries on disk. The names of any command files not listed on the directory screen may be viewed by pressing F10 (next page of dialing directory) by using the DIR command at the command prompt. (Command names may be input in either upper- or lower-case letters from the keyboard and in command files. In this article, commands are shown in upper-case letters and spelled out completely. At least two letters must be typed, and more may be needed in some cases to uniquely specify commands that have similar spellings.)

DATA CAPTURE

Telios incorporates an excellent large-capacity buffer that retains a record of the communications session up to the limit imposed by available memory. (Earlier versions of Telios limited the buffer to 20,000 characters.) Scrolling back

The name may conjure up Greek gods and satellites, but Telios is actually a generally reliable communications package that uses the Kermit protocol.

and forth through the retained information a line at a time (using the arrow keys) or in screen-sized pages (PgUp, PgDn), or jumping to the beginning (Home) or end (End) is instantaneous. Typing a key other than those used for buffer positioning causes a jump to the end of the buffer so that communications continue where they left off. A received character on the communications port has the same effect.

The standard DOS print-screen and echoing features have been retained in Telios. The commands use the DOS syntax of Shift-PrtSc to send the contents of the screen buffer to the printer and Ctrl-PrtSc to print simultaneously what is being displayed. At high line speeds (1,200 baud and up), simultaneous printing is discouraged unless the printer is fast enough to keep up with the input from the host in order to preclude data loss.

It is possible to record incoming data directly to a named disk file. The user should check for adequate available disk space before beginning the capture function, because error handling is limited. I filled a diskette while capturing data. Telios turned off the capture mode automatically and gave a warning message, which let me know what had happened, but it made no attempt to stop the host from sending more data and did not give me the opportunity to specify another drive or insert another diskette in place of the full one. Data capture is started by the command CAPTURE and ended by the command CLOSE. Alt-t or TOGGLE is used to stop and start data capture once it is turned on. A file name and optional drive letter tells Telios where to store the received data. The current version of the program does not provide full support for path names from PC-DOS 2.0 and later versions.

FILE TRANSFERS

For receiving ASCII text from a host computer, the data capture technique described above may be used. Telios also provides for XON/XOFF and turn-around prompting methods for transferring pure text files in either direction. The usual concerns about accuracy and data loss are associated with these techniques, so Telios provides two public domain error-checking protocols, XMODEM and Kermit.

Files of any type may be transferred between computers running software that understands the XMODEM protocol. The Telios implementation of XMODEM worked perfectly in tests with a variety of host computers. The protocol is selected by typing PROTOCOL XMODEM. Then the name of the file to be transferred is given to the host using the host's method of invoking XMODEM. Finally, the local system is told to receive (PCAPTURE [drive:]filename[.ext]) or send (PSEND [drive:]filename[.ext]) the file. A "panic" command (PANIC or Alt-p) can stop a protocol transfer at any time. Systems using only seven bits for data and one bit for parity that cannot be set to use eight data bits (parity = none) cannot use XMODEM, because it requires eight bits for transmitting data.

The Kermit protocol may be selected by using the command PROTOCOL KERMIT. The commands to send and receive files are

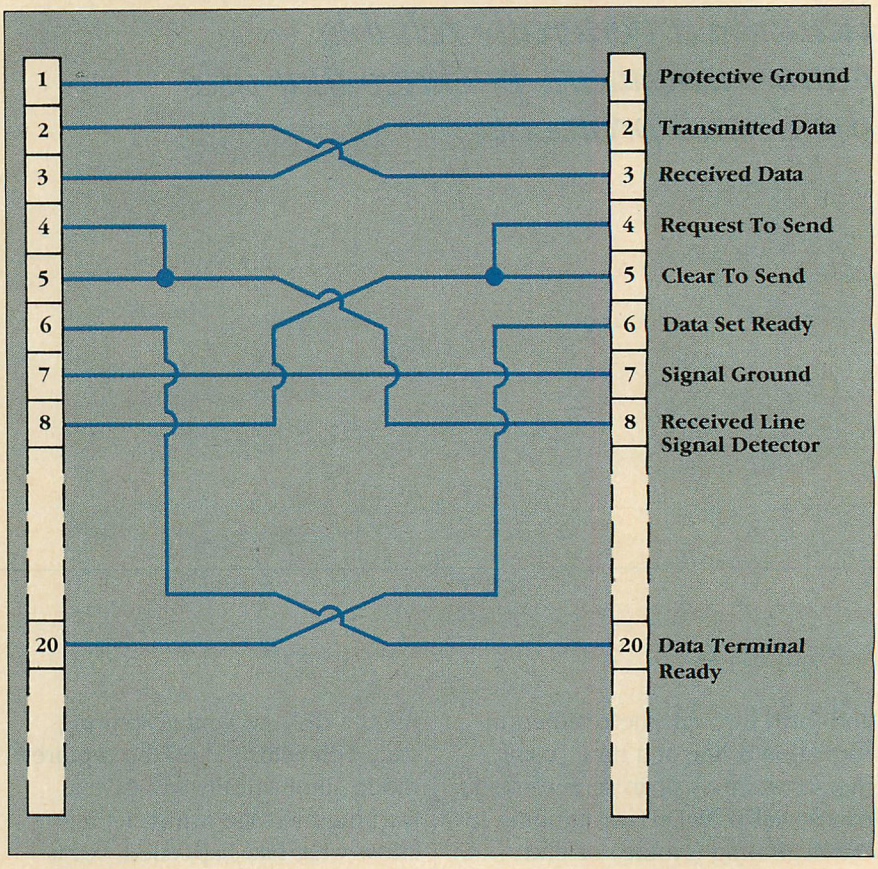
identical to those that are used for XMODEM. The Telios implementation of Kermit does not permit "directory" transfers. Only one file at a time may be named, and the name (and extension, if present) must be spelled out completely, which negates one of Kermit's primary benefits. Also, Telios is unable to communicate with a system running Kermit as a "server" host. If the host allows eighth-bit quoting and the two-byte checksum features, Telios can use them.

COMMANDS AND FILES

Table 1 lists the basic set of Telios commands and briefly describes their actions. The program has two major modes of operation: a conversation mode and a command mode. In the conversation mode, characters typed on the keyboard, except a few reserved combinations, are sent to the remote computer and those received from the host are displayed on the screen. The Alt-c combination places Telios in the command mode and prompts the user for a command on the bottom line of the screen. HELP typed in at the command prompt or Alt-h at any time displays the first of the six help frames. Continued use of Alt-h moves the user through successive help screens. After screen six, the help feature wraps back to the first screen in a circular fashion if Alt-h is pressed again. A null command (the enter key by itself) returns Telios to the conversation mode. Photo 2 shows the help screen for uploading and downloading files.

The commands listed in table 2 are those specifically designed for use in command files. They are not meaningful at the Telios command prompt. Although useful for many applications, the command set lacks some essential commands. Although Telios is able to wait for a particular character (either control or printable ASCII), it provides no way to wait for a specified string of characters to be received. Also, there are no logical operators to do conditional branching. This makes it impossible to write command files that automatically respond to varying operating conditions.

FIGURE 1: *The Wiring of a Null-modem Cable*



An external editor, such as EDLIN, is needed to prepare command files. This must be done outside of Telios, because Telios has no built-in editor and no provision to execute DOS commands. The status screen (shown in photo 3) that summarizes the settings of the major communications parameters is invoked by typing STATUS or Alt-s. A similar summary of the current function key definitions may be obtained by typing F? or Alt-f. The SAVE command saves all of the status and key definition information in a specified file so it may be called at a later time.

Genasys has provided sample command files for accessing various types of mainframe systems used in government and industry and one for logging on to THE SOURCE. Listing 1, SOURCE.TLS, shows most of the available commands in use for this log-on procedure and the format of the saved communications parameters and key definitions. Either of the two secondary command files, SOURCE.CM1 or SOURCE.CM2, may be selected manually via the function keys. Command files may be started automatically, as shown in the last line of the listing SOURCE.TLS.

POOR DOCUMENTATION

It is unfortunate that Telios is not better documented. Particularly disturbing is one claim in the Telios documentation that says "your PC can be . . . a Videotex terminal." Nothing could be further from the truth. Although Videotex incorporates normal text into the display

Dr. Dobbs says,

"WE HAVE GOOD NEWS...

"WINDOWS FOR C can offer you a convenient and reliable means of implementing windows in your text-handling programs...

"The video output is fast and clean, showing no snow with either the graphics or monochrome display.

"WINDOWS FOR C is documented in well-written and readable English, and it appears to be all there.

"WINDOWS FOR C...is a very nice software package that has obviously been well thought out and very cleanly executed.

"WINDOWS FOR C is a professionally-oriented set of programming tools...that we can recommend."

_ Ian Ashdown (*Dr. Dobb's Journal*, November 1984)

Full support for:

- **IBM PC/XT/AT plus compatibles**
- **All memory models of** Lattice C, CI-C86, Mark Wm. C, Aztec C, Microsoft C, Desmet C (PC/MSDOS)

Plus:

- **NEW: Driver interfaces for non-IBM displays**
- **Full source available**

More than a window display system, WINDOWS FOR C is a video toolkit for all screen management tasks.

C SOURCE is provided for pop-up menus, viewing of multiple ASCII files within multiple windows, cursor control for vertical and horizontal scrolling, label printing, and text-mode bar graphs.

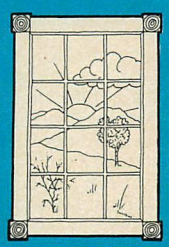
An object-code library of over 50 fully documented building-block subroutines allows you to construct functions to suit your needs.

Once you've used WINDOWS FOR C, you will wonder how you managed without it.

With WINDOWS FOR C you can:

- Establish any number of windows; clear, write, and control attributes of each window independently; write with word wrap and auto scroll; control all IBM color capabilities.
- Overlay and then restore screens, highlight selected text, format and print with windows, and save windows to memory or disk. Memory management is automatic.

Don't wait. Order now.



The Good News...

WINDOWS FOR C™

ADVANCED SCREEN MANAGEMENT

A PROFESSIONAL SOFTWARE TOOL FROM

CREATIVE SOLUTIONS

21 Elm Ave., Box T12 • Richford, VT 05476

802-848-7738

Master Card & Visa Accepted
Shipping $2.50
VT residents add 4% tax

WINDOWS FOR C (specify compiler & version)	**$195**
Demo disk and manual (applies toward purchase)	$ 30
Dealer inquiries welcome	

CIRCLE NO. 121 ON READER SERVICE CARD

screens it produces, its impact is lost unless the receiving terminal is able to handle its dot-addressable graphics, preferably in color.

The manual for version 2.0 is better than the version 1.1 manual in that it has a more detailed table of contents, dividers (but no tabs) separating chapters, and an appendix that summarizes all Telios commands. It still suffers from weak organization and a sparse index, however. In some cases, indexed items simply do not appear on the designated pages. One particularly irritating example is the item describing the switch settings for a Hayes Smartmodem. The item is not in the table of contents, and the index points to pages ii, iii, and I-23. There is no mention of Hayes on any of those pages. The information is actually found on page I-24.

In addition to unsupported claims of Videotex compatibility, the Telios manual writers claim intelligent terminal capability for the product, which stretches the point. In an earlier article ("High-Tech Mimicry," *PC Tech Journal*, September 1984, p. 47), I described a set of minimum capabilities a terminal or an emulation program must have to be considered intelligent. The Telios terminal is basically a dumb TTY with the ability to store data and transmit data from secondary storage (disk). That meets some, but not all, of the requirements.

GENERALLY RELIABLE

With the minor exceptions noted, Telios is a generally reliable product that is tolerant of errors. The user interface, however, is not easy to learn and use without a careful reading of the manual. Unlike some of the other communications programs I have reviewed, this one lacks an intuitive feel that would permit a user to fire it up and just experiment to find out how it works. The on-line help is not keyed to the user's situation; rather, it consists of a sequence of six

TABLE 1: *The Telios Commands*

AUTOLF	Enable/disable automatic linefeed
BAUD	Set transmission rate
BREAK (Alt-b)	Interrupt the current transmission or signal attention
CAPTURE	Save received data in a specified file
CHATTER	Control level of user feedback during protocol file transfers
CLOCK	Control display of current and elapsed time
CLOSE	Halt data capture to disk
COLOR	Control color setting for color adapter
DEFINE	Define the meanings of selected keys
DIAL	Dial a telephone number
DIR	Display the specified disk directory
DISCONNECT	Hang up the line
DO	Run a specified command file
ECHO	Select half- or full-duplex operation
EOF	Select binary or text style end-of-file marker
ERASE	Delete specified file(s) from disk
EXPAND	Select blank line expansion option
F? (Alt-f)	Display function key definitions
FILTER	Select received-character filtering option
FLOW	Select XON/XOFF flow-control treatment
HELP (Alt-h)	Display Telios help screens
PANIC (Alt-p)	Halt execution of the TYPE command or a protocol file transfer or ignore an XOFF signal
PARITY	Set parity to EVEN, ODD, SPACE, MARK, or OFF
PCAPTURE	Capture data to disk during a protocol file transfer
PORT	Select COM1 or COM2 port
PROTOCOL	Select XMODEM or Kermit protocol
PSEND	Send a file using the selected protocol
QUIT	Quit Telios, drop connection, and return to DOS
RETRIES	Set number of times to resend a packet
ROUTE	Save characters sent, received, or both to the capture file
SAVE	Save current parameters and definitions in a specified disk file
SCREEN	Select screen mode (NORMAL, MUTE, GRAPHIC)
SEND	Transmit a file to the remote system
STATUS (Alt-s)	Display the status overview screen
TCHAR	Wait for receipt of the specified character
TIMEOUT	Set timer interval (0 - 255 seconds)
TOGGLE (Alt-t)	Turn capture on if off, or off if on
TYPE	List the contents of the specified file
TWAIT	Time to wait after receipt of TCHAR before sending the next line (0 - 255 seconds)

TABLE 2: *Special Commands for Command Files*

LIST	Controls display of command names in the message area as they are executed from a command file—useful for testing and debugging (default=OFF)
MSG	Displays message text on the screen regardless of the setting of the LIST parameter
REMARK	Allows comments in command files and displays those comments with command names if the LIST parameter is ON
SLEEP	Instructs Telios to pause for the specified time before sending the next command in a command file
WAIT	Tells Telios to wait for an event (TCHAR) and an accompanying time interval (TWAIT) before running the next command in the command file
XSTRING	Transmits the following text string to the host—the string may be up to 255 characters long

Available for the IBM PC, AT, XT, jr., and true compatibles*

GOT YOUR SIDEKICK™ YET?

The Super Organizer

Whenever you're using your computer . . . from start to finish of your session Sidekick™ will be there . . . ready to serve. And it's as lightning-fast and compact as only Borland knows how to make it.

There's a notepad that has a full-screen editor that can time and date stamp your notes, and then save them to disk. You can even pull information into the notepad directly from the screen of your "underlying" software.

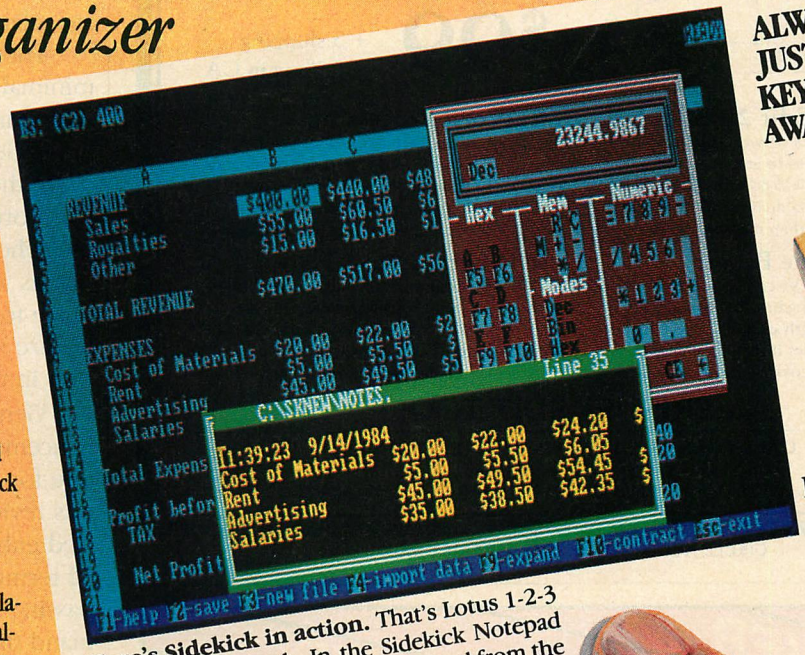
Suppose you're working in Lotus and the phone suddenly rings. Give your Sidekick a call and it pops right up over Lotus with the notepad you need. Or an appointment calendar . . . one you can never misplace.

What if you need to do a quick calculation? A keystroke instantly brings up the calculator. And the results of your calculations can even be transferred to your "underlying" software.

Need to make a phone call? Up pops your personal phone directory. Type in the name you want . . . and Sidekick jumps right to the phone number. Another keystroke, and the phone is automatically dialed for you.**

There's lots more, too. You can move the Sidekick windows anywhere on the screen you like. And you can have as many on screen at a time as you need. There's even an on-line help window for each of Sidekick's features.

We designed it because we needed it. If you've ever been writing a report and needed to do a quick calculation, or jot down a note, then you need Sidekick, too.



Here's Sidekick in action. That's Lotus 1-2-3 running underneath. In the Sidekick Notepad you can see data that's been imported from the Lotus screen. On the upper right, that's the Sidekick Calculator.

ALWAYS JUST A KEYSTROKE AWAY . . .

INTRODUCTORY OFFER

$49.95

Copy Protected Version

***Only with Hayes Smartmodem and compatibles.*

WHETHER YOU'RE RUNNING LOTUS, WORDSTAR, dBASE OR WHATEVER . . . JUST A KEYSTROKE AND A SIDEKICK WINDOW OPENS . . .

- A CALCULATOR
- A NOTEPAD
- AN APPOINTMENT CALENDAR
- AN AUTO DIALER
- A PHONE DIRECTORY
- AN ASCII TABLE

'IF YOU USE A PC, GET SIDEKICK. YOU'LL SOON BECOME DEPENDENT ON IT."
erry Pournelle, BYTE

YOU CAN ORDER YOUR COPY OF SIDEKICK™ TODAY!

For VISA and MasterCard orders call Toll Free **1-800-255-8008** in California **1-800-742-1133**
(lines open 24 hours, 7 days a week) Dealer Distributor Inquiries Welcome 408-438-8400

SIDEKICK™ $49.95
Non-copy protected
Version: $79.95
(Plus $5.00 shipping and handling.)

Check ☐ Money Order ☐
VISA ☐ MasterCard ☐

Card # _____

Expiration Date _____

*PC jr. runs non-copy protected version only.

Please be sure your computer is an IBM PC, AT, XT, jr., or true compatible!

NAME _____

ADDRESS _____

CITY/STATE/ZIP _____

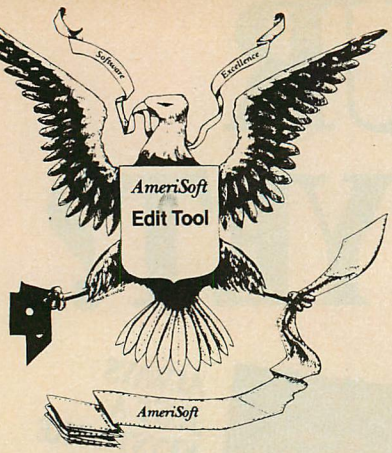
TELEPHONE _____

California residents add 6% sales tax. Outside U.S.A. add $15.00. (If outside of U.S.A. payment must be by bank draft payable in the U.S. and in U.S. dollars.) Sorry, no C.O.D. or Purchase Orders.

THE SOFTWARE CHAMPIONS

BORLAND INTERNATIONAL

Borland International
4113 Scotts Valley Drive
Scotts Valley, California 95066
TELEX: 172373



MULTI-FILE EDITOR with WINDOWS

$99 + 3 shipping + 5.94 tax in CA

- **Browse/Edit 20 Files**
  - Move blocks between files easily
  - Instant access to any line in file
  - Complete DOS commands w/directory
  - Use all available memory to 640K
  - Files larger than memory no problem!
- **Mainframe Power**
  - Xedit/SPF/Vi compatibility
  - Display and edit in HEX and TEXT
  - Record length up to 60,000 bytes
  - Edit data files in Fixed Length
  - Work is recovered if power fails
- **Word Processing**
  - Easy to learn command menus w/help
  - All char/word/line/page commands
  - Line numbers, tabs, indents, wordwrap
  - Left justify and reform paragraphs
  - Move, copy and fill column blocks
- **Programming Tool**
  - Build new commands while editing
  - 10 buffers for temporary storage
  - Search col/line ranges with wildcards
  - Undo 2,000 changes, even huge deletes
  - Configure all options in startup file

AMERISOFT EDIT TOOL™

CALL TOLL FREE FOR IMMEDIATE SHIPMENT
1-800-358-9092 x627 CA: 1-800-862-4982 x627
345 South McDowell #410 • Petaluma, CA 94952 • 707-778-8594

CIRCLE NO. 166 ON READER SERVICE CARD

IF POWER FAILS, DATASAVER® TAKES OVER!

PROTECTION – saves data during power failures.
– saves hardware from overvoltage transients.
PORTABILITY – allows mobile or extended holdup time using auxiliary 12 volt battery.
FEATURES – internal battery provides 5 min. + operating time – AC line conditioning
– audible and visual alarms, interrupt signal – compact, desktop styling
– no installation required.

200 WATT – $495 / 90 WATT – $350
IBM PC/XT PC jr.

Instant power order line
805-541-4161

VISA MasterCard

CUESTA SYSTEMS, INC.
3440 Roberto Court, San Luis Obispo, California 93401

INSTANT AC POWER

CIRCLE NO. 122 ON READER SERVICE CARD

TELIOS

screens that convey general information about the program. This is in sharp contrast to the superb context-sensitive help feature of VMPC's Relay (see "Instant Relay," *PC Tech Journal*, October 1984, page 95).

The weakest element of the Telios package is its documentation; it is lacking in organization, coverage, clarity, and indexing.

The Kermit implementation is a minimal subset, of Telios, but it is usable in most file-transfer applications. Genasys should at least include the directory transfer capability in order to pacify lazy users like me, who refuse to type 20 commands when one should be adquate to do the job. The remote feature would be a welcome addition in the future.

Genasys promises some enhancements to Telios in version 3.0, due for introduction about the time this review is published. The promised enhancements include VT100/52 terminal emulation, parameter passing and logic paths for command files, and the ability to quit Telios while maintaining the active connection—essentially a digital "hold" feature. The hold feature was available in version 1.1, but was inexplicably removed from version 2.0. Customer pressure has encouraged Genasys to put it back into Telios. In many European and Asian countries, for example, a telephone connection is a precious commodity that is not readily relinquished. Thus, the ability to exit to DOS to perform some task and then return to the communications session without breaking the connection is an essential capability.

Program updates from earlier versions to version 2.0 cost $20 to registered owners. The same policy will probably apply to upgrades from version 2.0 to 3.0 as well, according to a Genasys representative.

THE EXPERIMENTAL VERSION

Genasys is taking a new distribution approach that gets working copies

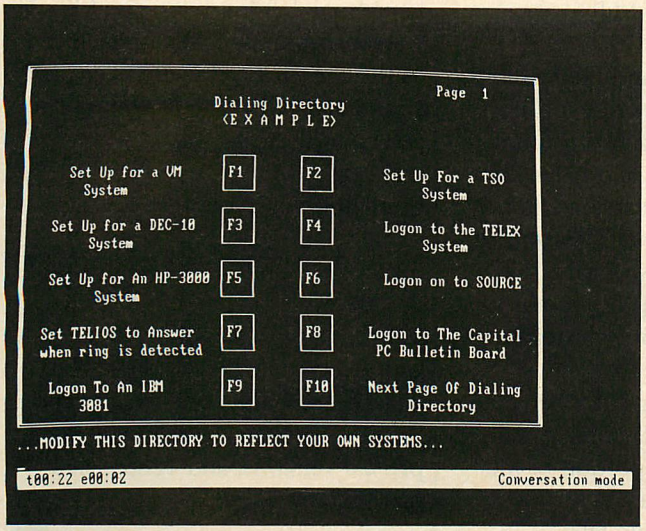


PHOTO 1: *The Telios Dialing Directory*

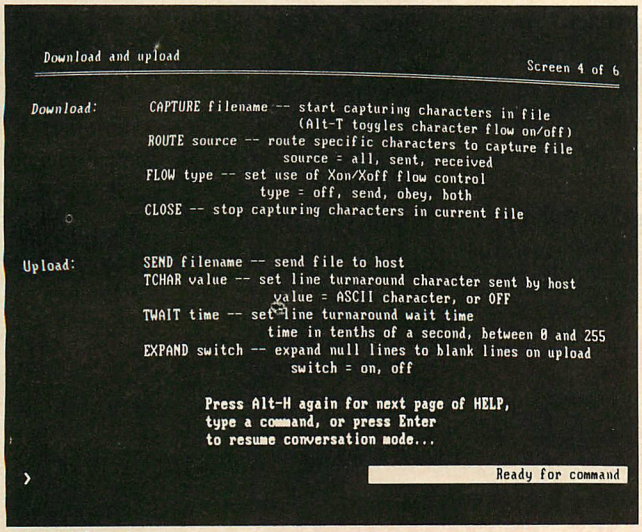


PHOTO 2: *A Typical Telios Help Screen*

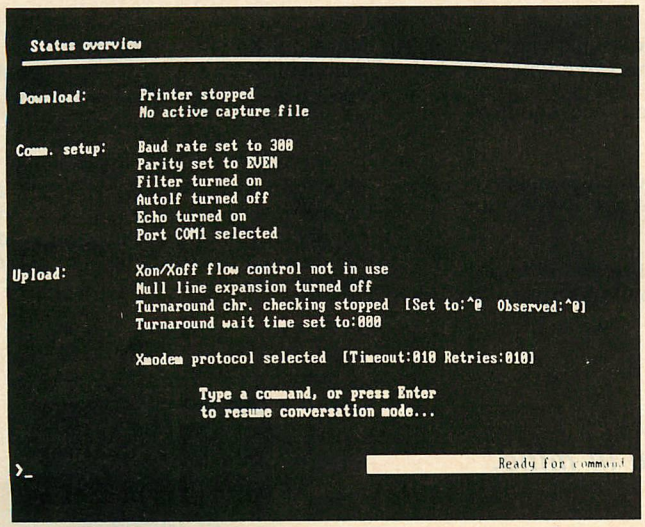


PHOTO 3: *Telios Status Screen*

PROGRAMMER'S DEVELOPMENT TOOLS

C LANGUAGE:

	List	Ours
Computer Innovations C-86	395	**309**
DeSmet C Compiler with Debugger	159	**145**
Lattice C Compiler	500	**299**
Wizard C	450	**409**
Xenix Development System by SCO	1350	**1099**

***** Mark Williams C Compiler *****

Sale Priced at $429

This highly optimized compiler includes an extremely useful source-level debugger which can save you hours of programming time. A truly professional C development system with too many features to list.

OTHER LANGUAGES:

8088 Assembler w/Z-80 Translator 2500 AD	100	**89**
BetterBASIC by Summit Software *Sale!*	200	**149**
Janus/ADA + Tools by R&R	700	**499**
Modula-2/86 by Logitech	495	**439**
STSC APL*Plus/PC *We Can Support You!*	595	**499**

*** Morgan Computing Professional BASIC ***

New low price $89

This structured BASIC semi-compiler with debugger supports large workspaces and many extensions. 8087 support $45.

UTILITIES:

CodeSmith-86 by Visual Age	145	**129**
Communications Library by Greenleaf	160	**139**
C-Tree by Faircom	395	**359**
C To dBase by Computer Innovations	150	**139**
C Utility Library by Essential Soft.	149	**129**
ESP for C by Bellesoft	349	**319**
FirsTime for C by Spruce Tech	295	**269**
GraphiC from Scientific Endeavors	195	**169**
Greenleaf Functions Library	175	**159**
Halo *Color Graphics*	200	**125**
Panel *Screen Design/Editing* by Roundhill	295	**234**
Periscope *Debugger* by Data Base Decisions	295	**269**
Phact by Phact Associates	395	**359**
Plink-86 *Overlay Linkage Editor*	395	**310**
Pmate by Phoenix Software	225	**175**
Profiler by DWB & Associates	125	**99**
Screen Sculptor by Software Bottling	125	**109**
Windows For C by Creative Solutions	195	**159**

***** Scroll & Recall *****

$49

Save $20 on this DOS-resident Screen and Keyboard utility. S & R allows you to recall text that has scrolled off the screen. You can also recall and edit all of your previously entered DOS commands.

Prices are subject to change without notice.

Call for our New Catalog consisting of 200+ Programmer's Development Tools Exclusively for IBM PC's and Compatibles.

Account is charged when order is shipped.

VISA **1-800-336-1166** MasterCard

Programmer's Connection
136 Sunnyside Street
Hartville, Ohio 44632
(216) 877-3781 (In Ohio)

"Programmers Serving Programmers"

CIRCLE NO. 226 ON READER SERVICE CARD

of future releases of their products into the hands of customers before the final versions are officially on the market. Beginning in November 1985, customers received a diskette that contains both the current distribution of the Telios program and a program named TeliosX, the "experimental" version, which contains features of the coming official release. Because the program is not fully tested, it may contain some bugs or features that are not fully perfected. (Of course, some companies already engage in this practice, but they don't tell customers that their program is experimental.)

The new features alluded to in my review of Telios are real and are available to purchasers of Telios now in this prerelease package. They will become official in early 1985 when all product testing and documentation updates are finished. The following items are included in the updated program:

- DEC VT100/52 emulation
- Subdirectories and file path names recognized
- Enhanced command file facilities, including conditional execution (if . . . goto), interactive prompting, input queing and parameter passing, host transactions (anticipated actions, conditions, and received character strings)
- Automatic back-up of "capture" files (they were overwritten in earlier Telios versions)
- Control of border color separate from background color
- Save data from a portion of the screen buffer to a file
- Default and settable tabs
- DOS file commands (CHDIR, RENAME, DRIVE, etc.)
- "Ring" and "answerback" strings

Some changes were made in the way a user moves about in the screen buffer to accommodate the use of cursor keys in the emulate modes. The VT100 emulation is reasonably complete and worked well. Some features of the DEC terminal have been left out because of hardware constraints, and others, such as the screen alignment display and smooth scroll, are not deemed necessary by the designers. Genasys will entertain opposing views from users and will incorporate other capabilities if there is sufficient demand for them.

Because of changes made to Telios, this experimental version requires PC-DOS 2.0 or a later version of DOS and additional memory (DOS uses more mem ory than pre-2.0 versions, and Telios itself has become larger).

Telios, Version 2.0
Genasys Corporation
11820 Parklawn Drive
Rockville, MD 20852
301/770-4600
Language: Macro Assembler
$119.95

CIRCLE 479 ON READER SERVICE CARD

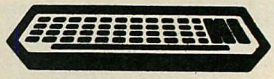
Scientific/Multi-Lingual Word Processing Without Control Codes The Pelada Text Engineer

Advanced features *designed with you in mind:*

1. All functions performed from a command line: **NOT** menu or Alt-Key driven. Just watch the screen and touch the keys.
2. Comprehensive On-line help accessed by two keystrokes.
3. On screen **bold**, *italics*, underlining and centering.
4. Fastest software available for the PC: Full screen of text displayed in 0.2 seconds.
5. New convenience: Four files may be held in memory at the same time.
6. Never lose it: Stacked recovery of all deletions.
7. Customize your document format: editable tableaus of page and window parameters.
8. Paper elimination: View two different files on separate monitors simultaneously.
9. Never "Get Lost": The cursor automatically returns to the original spot after any operation has been performed on the document.
10. Error control: An error message is displayed on the command line to alert the user of potential software crashing situations (i.e., printer disconnected or file disk not in disk drive etc.) before they occur.

THE TEXT ENGINEER *Designed with you in mind.*

SAMPLE DISK AVAILABLE FOR $20.00



Pelada Informatica Inc.
87 Queen St.,
Kingston, Ontario
CANADA K7K 1A5
Tel. (613) 549-1747

CIRCLE NO. 141 ON READER SERVICE CARD

LISTING 1: SOURCE.TLS

```
REM *** THIS IS AN EXAMPLE OF A COMMAND FILE TO LOGON TO THE SOURCE ***
REM *** CHANGE THE AREAS NOTED BELOW ***
REM *** CHANGE THE BAUD RATE TO MATCH THE SYSTEM AND MODEM
REM     YOU'RE USING ***
baud 300
parity off
echo off
autolf off
protocol off
filter on
define prefix AT DT
REM *** INSERT THE TELEPHONE NUMBER IN YOUR AREA FOR THE SOURCE ***
define number <THE TELEPHONE NUMBER GOES HERE>
define suffix ^M
tchar off
twait 000
expand off
define 1 ^1DO SOURCE.CM1^M^M
define 2 ^1DO SOURCE.CM2^M^M
define 3
define 4
define 5
define 6
define 7
define 8
define 9
define 10
define enter ^M
define bs ^H
clock on

REM *** SET THE COMMAND FILE TO WAIT FOR AN "@" PROMPT ***
twait 5
tchar @
dial
SLEEP 5
TCHAR >
REM *** INSERT THE CODE ASSIGNED BY THE SOURCE BELOW
XSTRING <YOUR COMPUTER CODE GOES HERE>^M
REM *** AN EXAMPLE IS: "XSTRING C xxxxxx^M" TO TRANSMIT AN
REM     ID OF xxxxxxx AND A CARRIAGE RETURN ***
TCHAR ^$
TWAIT 30
TCHAR ?
TWAIT 0
REM *** INSERT YOUR SOURCE ID BELOW
XSTRING ID <YOUR ID GOES HERE>^M
tchar P
TWAIT 20
REM *** INSERT YOUR PASSWORD BELOW ****
XSTRING <YOUR PASSWORD GOES HERE>^M
tchar >
TWAIT 0
REM *** THE FOLLOWING SET YOUR SOURCE SESSION INTO COMMAND MODE ***
XSTRING 6^M
TCHAR OFF
MSG
MSG
REM *** THE FOLLOWING RESETS ALL 10 FUNCTION KEYS ONCE
REM     LOGON IS COMPLETED ***
DO SOURCE.CM1^M
```


SOFTWARE DEVELOPERS

Save thousands of dollars! Save hundreds of hours!

by using our assembly language sub-systems

F A B S

fast B-tree keyed access sub-system

- Rapid access and maintenance of large files with fixed-length records
- Versions available for CP/M-80, MP/M-II, CP/M-86, MS-DOS, PC-DOS, Microsoft BASIC(s), COBOL, FORTRAN, PASCAL, PL/I, CBASIC, CB80, CBASIC86, CB86.
- FABS directs all Access, Insert, and Delete file operations
- Key length may be greater than 50 bytes, and six key files open simultaneously
- Multiple primary key and multi-level key plus duplicate and variable-length keys are supported
- Random search time approximately 1 second, sequential step 1/4 sec.
- Deleted records are automatically reclaimed by subsequent insert operations
- Key files never need to be re-sorted: excellent error handling
- Generic search returns the first occurrence of partial key; search-next provides sequential read
- Loads resident with DOS, occupying less than 15k bytes
- Easy to incorporate into existing file-intensive applications
- Extensive commands: Create, Open, Close key file, Search (first, last, next, previous, generic), Insert, Delete, Replace key, Max Length, Open Deletes, # of Records, # of Keys

A U T O S O R T

high speed Sort/Merge/Select sub-system

- Optimized for very large files; stand-alone or callable subroutine; diskettes may be changed during operation
- Versions available for CP/M-80, MP/M-II, CP/M-86 and MS-DOS, PC-DOS running Microsoft BASIC(s), FORTRAN, PASCAL, CBASIC, CB80, CBASIC86, CB86.
- Record size may exceed 5000 bytes, and file length is unlimited
- Sorts based on up to 10 fixed or variable length keys, each ascending/descending
- Key fields may be string, integer, single or double precision numeric
- Output files may consist of full records, key with record pointer, and record pointer only
- Select for retain/delete based on up to 4 keys, AND, OR, > < , =, conditions
- Single or multi-user; sorted files may be merged
- Fast . . . 4000 records of 128 bytes sorted to give key and pointer file is 170 seconds
- Boot straps itself into and out of memory claiming/restoring memory automatically
- Up to 9 different Sort/Merge/Select Modes of operation; parameters defined at run-time or read from a file
- Interactive parameter set-up program is supplied; files may be on disk drives A-Z

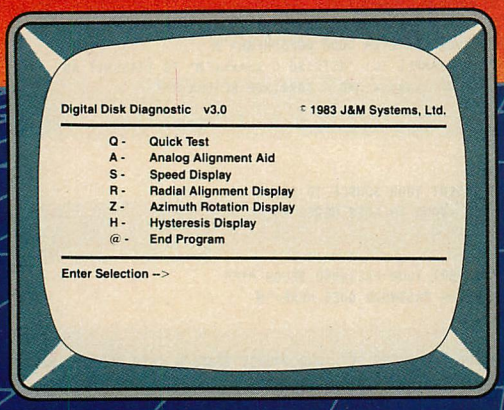
Retail Price $150 Each + Shipping (OEM Dealer Discounts)

COMPUTER CONTROL SYSTEMS, INC., 298 21st Terrace S.E., Largo, FL (813) 586-1886

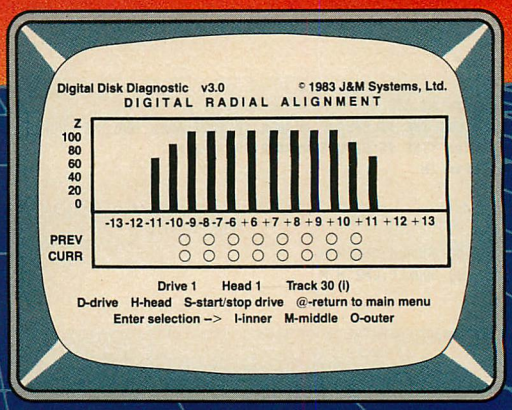
CIRCLE NO. 114 ON READER SERVICE CARD

DISK DRIVE ANALYSIS PROGRAM

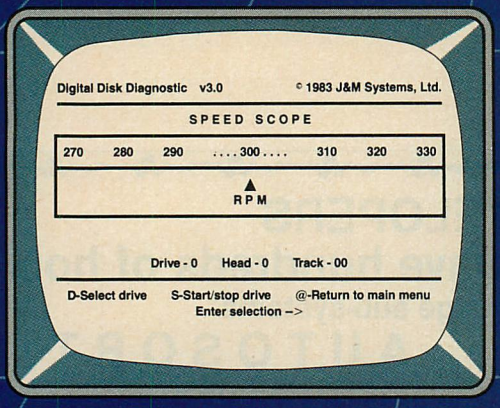
. . . A UNIQUE APPROACH TO DISK RELIABILITY!



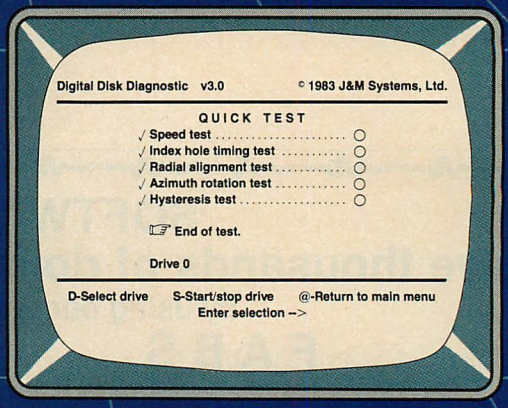
Select any one of seven tests to perform preventive maintenance or to isolate problems. Simple, single-letter commands make DDA easy to use! Use DDA to align the head, or adjust the speed.



Use the DDA Radial Alignment Test to check the head alignment of your drives. No need for an oscilloscope or other expensive test equipment!



Check the motor speed of your drives. Or, you can even use the Speed Test to adjust the drive speed. No need for any test equipment!



Use the Quick Test to quickly and automatically test five of the most important performance parameters of your drive. Monitor your drives for long term drift. Isolate problems quickly and automatically!

PROTECT YOUR DATA.

Now you can make sure your data is being recorded properly by the use of the revolutionary ***Disk Drive Analysis Program.***

The Disk Drive Analysis Program from J & M Systems, tests your disk's performance and calibration without any additional equipment! It measures your disk's performance and displays it on your screen.

This is the most comprehensive disk diagnostic program available for your IBM microcomputer. You can even adjust drive alignment while watching the display!

Spot problems ***before*** they endanger your data! If you own a disk drive, you ***need*** the ***Disk Drive Analysis Program!***

	Price #
IBM	
1 - 160K Drives	$79
2 - 320K Drives (Also test 160K drives)	$99

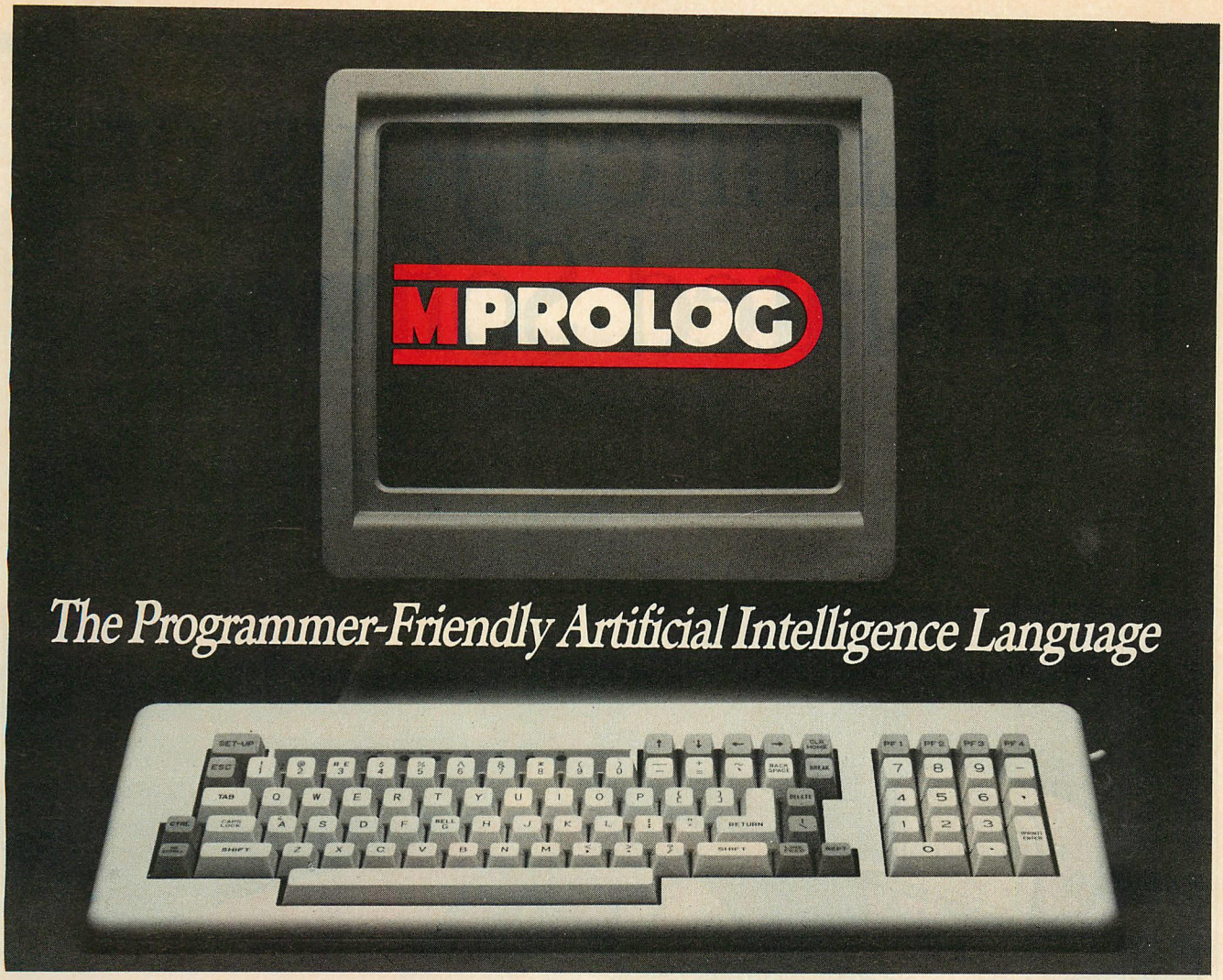
DDA also available for other models

J & M SYSTEMS IS THE DRIVING FORCE!

J & M SYSTEMS, LTD.

137 UTAH NE • ALBUQUERQUE, N.M. 87108 • 505/265-1501

CIRCLE NO. 205 ON READER SERVICE CARD



In what is unquestionably one of the most dramatic breakthroughs in the entire field of Artificial Intelligence (AI), a new modular version of the logic based programming language Prolog is now available exclusively through Logicware.

A refined, programmer-friendly version of Prolog — the computer language selected as the basis for the Japanese Fifth Generation Computer System Project — MPROLOG has a wide and powerful range of business, industrial and research applications.

With MPROLOG you can:

- protect the corporate investment in expertise
- create efficient expert systems,
- shorten programming development times
- provide transportability of applications

Why MPROLOG Was Developed

It has long been a dream of system developers to create a programming language which could be used to describe a problem without having to program explicit steps towards a solution.

A program whose execution corresponds to a **controlled deduction** through facts, relationships and rules.

A program that will enable computers to learn, associate, draw conclusions and make decisions.

MPROLOG is that program language, **the language of artificial intelligence.**

When MPROLOG Can Be Used

MPROLOG can be used for:

- Expert Systems
- Deductive Databases
- Natural language understanding
- Computer-aided learning
- Fault diagnosis and repair
- Visual perception and guidance
- Intelligent Assistants
- Many areas of Artificial Intelligence

> "Day-to-day use of MPROLOG... by programmers working with specialists...over the past eight years has produced some 30 applications spanning everything from architecture to pharmaceutical research."
> The Financial Times, London (U.K.) November 13, 1983

MPROLOG Offers Seven Key Features

1. High performance with efficient use of resources
2. Hardware and operating system independence
3. Modular design capability; allows subsets of the problem to be specified and tested, offering substantial increases in productivity
4. Program development environment
   - Interactive Program Editor
   - On-line "help"
   - Concurrent editing and error correction
   - Program Trace
   - User-defined error handling
   - Efficient garbage collection
   - Over 250 built-in predicates
5. Interfaces to procedural languages and database managers
6. On-going support and enhancements
7. Comprehensive documentation and education

MPROLOG Works In A Flexible Operating Environment

The MPROLOG system is available on IBM mainframe computers under VM/CMS and MVS/TSO and Digital Equipment's VAX/VMS and VAX UNIX. Versions for the "super-micros" based on the M68000 CPU and the IBM PC-XT and AT are currently available with additional versions scheduled for release later this year.

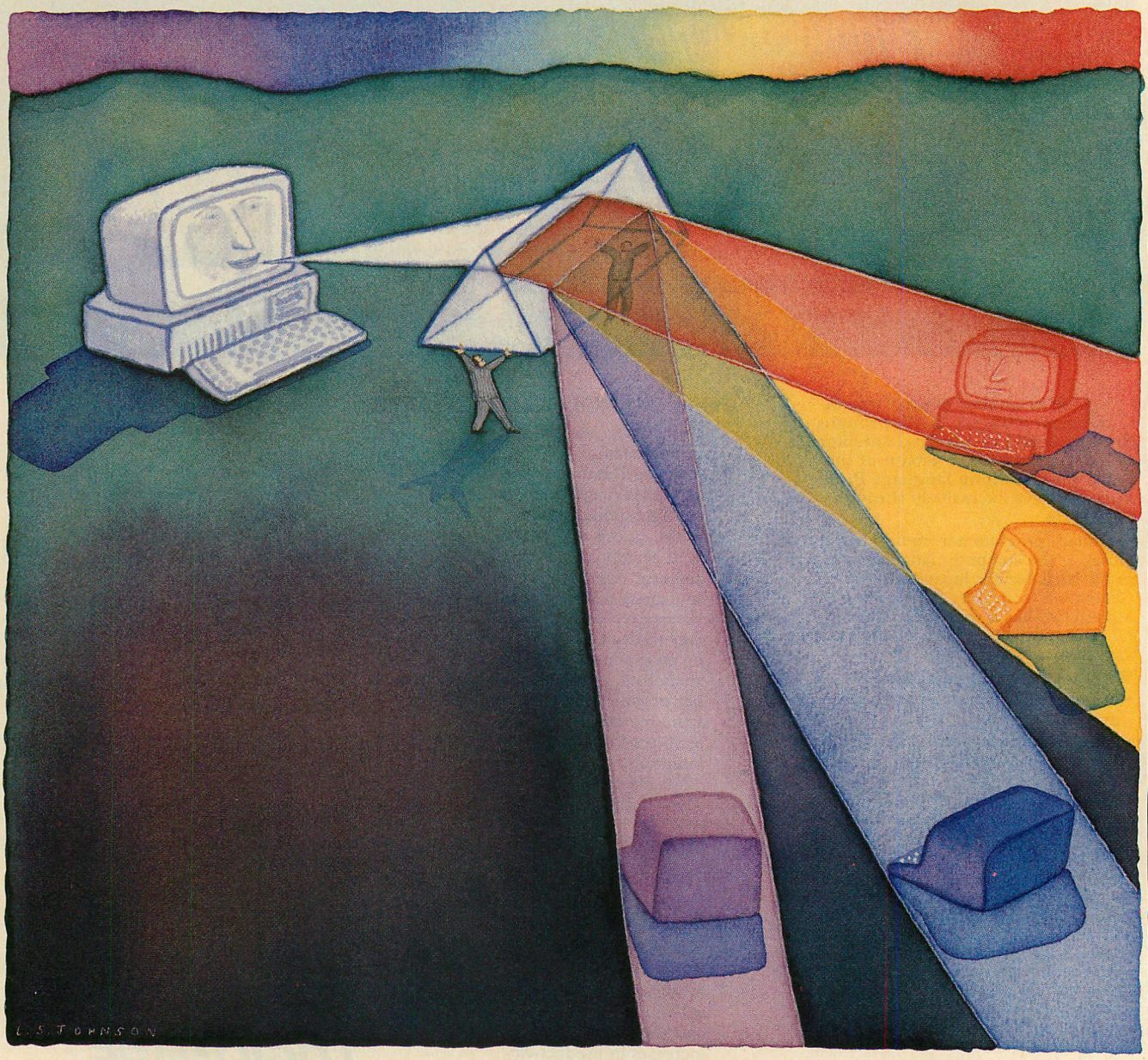
To find out more about MPROLOG and Logicware call **1-617-547-2393**
(In Canada 1-416-665-0022)
or write
Logicware Inc., 1000 Finch Avenue W., Ste. 600, Downsview, Ontario Canada M3J 2V5

LOGICWARE
Boston • Toronto • Los Angeles

CIRCLE NO. 151 ON READER SERVICE CARD

The Limited Joys of Translated Software

JAMES CREANE



Quick and easy translations from the CP/M environment provided software for the PC when it was needed, but shortchanged the expanded capabilities of the PC.

In the beginning—less than two years ago—WordStar, VisiCalc, and dBASE II ruled both the CP/M and MS-DOS worlds. They were the word-processing, spreadsheet, and database programs that most users preferred. They were limited, however, by their CP/M and Z80 origins, and have been challenged by more recent products written specifically for the PC market, such as Lotus 1-2-3, WordPerfect, and MultiMate. Lotus 1-2-3 and WordPerfect, for example, are written in 8086 assembly language, so the programs are very fast and they use memory effectively.

Initially, however, VisiCalc, WordStar, and dBASE II were welcomed for the PC. In fact, almost all of the early software for the PC was translated, cross-assembled, or cross-compiled for PC-DOS and the 8088 CPU. The time has come to question the efficiency and effectiveness of how such software was implemented for the IBM.

Users are primarily concerned about whether or not a particular program has the functions they need in order to implement their applications. However, the quality of the available system software, such as compilers, translators, and operating systems, determines the quality of the applications software.

One of the problems with implementing CP/M software on the PC was the 64KB of memory. The operating system and the applications program had to reside within this amount of memory. For some machines, such as the original Apple, both the operating system and program had to reside in less. To fit large applications such as WordStar and dBASE II into 64KB of RAM, an overlay linker was used.

An overlay linker allows one program to call another. WordStar has WS.COM (about 20K), which calls the overlay file WSOVLY1.OVR (about 40KB). With 64KB of RAM available, the memory was insufficient to have the entire program and the CP/M operating system resident at once. dBASE II uses a similar overlay file. Constantly reloading the overlay files slows down the program and increases the wear and tear on the disk drives.

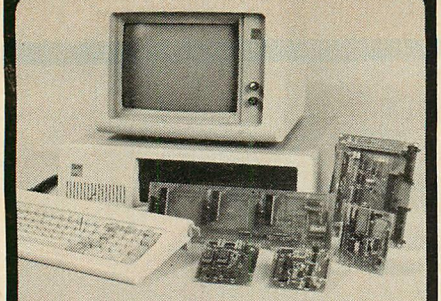
A second problem was the lack of widely implemented higher level languages for CP/M and the Z80. Viable C compilers, for example, started to become available only in 1981. Prior to that, C-BASIC, from Digital Research, was the prevalent language for commercial applications, and Microsoft's MBASIC was used for statistical applications. Several Pascal compilers were available, but they were not widely used for commercial applications. PL/1 was also available, but not widely used. Hence, assembly language was often seen as the only viable alternative for early programmers.

The first microcomputer CPU was Intel's 8080. Then Zilog's Z80 was introduced with additional registers and with a superset correcting many of the deficiencies of the original 8080 instruction set. The problem was that all instructions for the 8080 would run on the Z80, but, conversely, not all Z80 instructions would run on the 8080.

The most profitable solution to this problem was the least common denominator approach—writing code to run on any CP/M machine. Until recently, applications programs used the 8080's instruction set despite the advantages in the Z80's additional instruction set. It is only in the last two years or so that some CP/M applications have stated that they run only on the Z80.

A similar problem may occur now that IBM is basing its new AT on the 80286. The instruction set for the 8088 is a subset of the 80188's instruction set, which in turn is a subset of the 80286. Instead of ever onwards and upwards, users may get ever onwards and

James Creane, who lives in New York City, has written extensively on databases, statistics, and the 8087. He has converted mainframe FORTRAN programs to run on the PC.



We Bring Engineers, Scientists & the IBM-PC Together

Modular Data Acquisition System

- 12-bit resolution
- 24 KHz throughput rate
- 16 channel single ended, 8 channel differential
- LABSTAR Software

$690.00

- 8-bit resolution
- 30 KHz throughput rate
- 16 channel SE, 8 DI

$390.00

IEEE-488 GPIB Multifunction Board

- Full GPIB controller capability
- Three 16-bit interval timers
- 24 digital I/O lines
- Software included

$495.00

Waveform Synthesizer Board

- Generates user-definable signal
- Up to 2000 points per envelop
- 200 ns maximum output rate per point

$595.00

Call or write for a complete list of our data acquisition products and other quality products for your IBM-PC, including our RS-232C/RS422 Serial Communications Board, Counter/Timer Module, and 8-bit or 12-bit D/A Modules.

QUA TECH, INC.
478 E. Exchange St.
Akron, OH 44304
(216) 434-3154
Please call for more information.

CIRCLE NO. 190 ON READER SERVICE CARD

sideways. For example, programs written for the 8088 may not be rewritten to take advantage of the additional instructions for the 80188, because the original object modules should run, however slowly, without modification. This is especially likely for translated CP/M software.

TRANSLATORS, CROSS-COMPILERS, AND CROSS-ASSEMBLERS

The introduction of the IBM PC with an 8088 CPU and PC-DOS posed considerable problems for CP/M software houses that had large Z80/8080 assembly language programs. The chief incentive for writing in assembly language is to get the fastest executable code. But there is an important trade-off in exchange for this speed: assembly language source code has little portability to another CPU. Assembly language programs are fast because they make maximum use of the idiosyncracies of the architecture of a particular CPU, and each type of CPU has a different instruction set—even for common arithmetic operations. For example, the Z80 addresses its 64KB in memory as a continuous linear stream, but the 8088 uses segments and offsets to address memory. Hence, the speed is gained at the expense of tying the source code to a particular CPU.

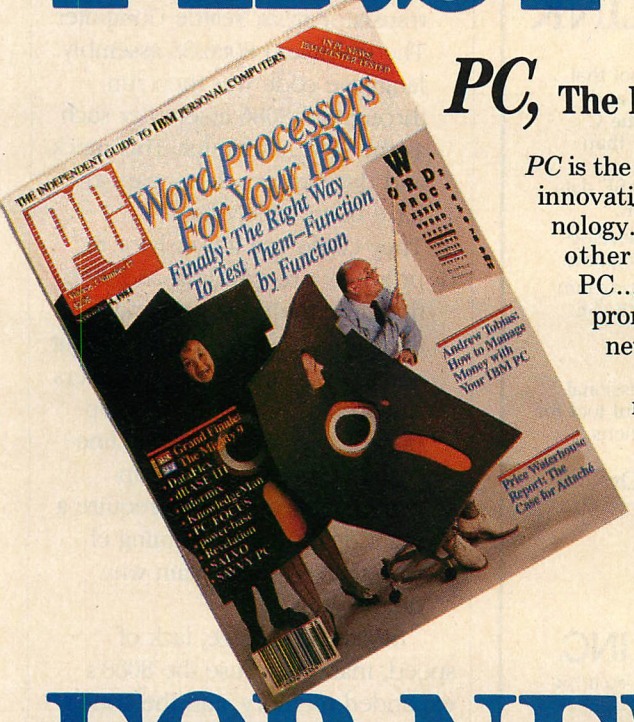
Micropro, Ashton-Tate, and others faced the problem of getting their programs to run on a different CPU under a different operating system. Their choices were:

1. They could do a line-by-line translation of their Z80/8080 source codes into 8088 assembly language and then use the IBM Assembler to produce fast, efficient applications programs. So far, none of the CP/M software houses has done this. Lotus 1-2-3 and WordPerfect may be the only major applications written in 8088 assembly language.
2. They could join the mass migration to C and rewrite their source codes entirely. Perfect Software followed this road with Perfect Writer. C source code then is supposed to be readily portable between different CPUs and operating systems. But Perfect Software spent almost two years converting their applications for the IBM. The delay may have cost them their market share—many good word processing packages became available sooner than Perfect Writer.

Application houses, including CP/M houses, are rewriting their applications in C with the expectation that C will be the Esperanto of computer languages.

3. They could use a cross-assembler that would take their Z80/8080 assembly language source codes as input. The cross-assembler would output 8088 object code that would then be linked to produce an executable file. Seattle Computer and Sorcim, for example, made such cross-assemblers. Cross-compilers do the same for higher level languages. Fast, efficient, and reliable cross-assemblers and cross-compilers are rare for microcomputers. The initial benchmark tests comparing the lackluster performance of IBM BASIC with Microsoft's CP/M MBASIC evidence this. (See *Byte*, January 1981, for an example.)
4. They could use a translator to convert Z80 assembly language into 8080 assembly language. Three such translators were available when the PC was ini-

FIRST CHOICE



PC, The Independent Guide To IBM Personal Computers

PC is the only magazine that keeps you up-to-date with the newest trends, innovations, and releases in IBM and compatible personal computer technology. Every-other-week, you'll receive the most current news on how other users and professionals like yourself are using their IBM PC...you'll discover the newest hardware on the market and what it promises (and actually delivers) to you and your system...and you'll never be out-of-date with the newest releases in software.

In short, when you subscribe to *PC* you're subscribing to the one magazine most IBM PC users read to maximize their system.

If you're a very special person who uses an IBM PC or compatible, you owe it to yourself to subscribe to *PC*, your source for new ideas, information and innovations.

ACT TODAY AND SAVE UP TO 26% AND GET UP TO 8 BONUS ISSUES!

FOR NEW IDEAS, INFORMATION & INNOVATIONS...

YES,

Check one:
- ☐ Payment enclosed
- ☐ Bill me later

Charge my:
- ☐ American Express
- ☐ Visa ☐ MasterCard

Card No._____

Exp. Date_____

PT8Z177

P.O. Box 2443, Boulder, Colorado 80322

I'm a very special person that uses an IBM PC. Please enter my subscription to *PC* for:

- ☐ 20 Issues for $21.97! Less than $1.10 a copy! AND ADD 4 BONUS ISSUES!
- ☐ 40 Issues for $39.97! Less than $1.00 a copy! AND ADD 8 BONUS ISSUES!

Savings based on a single copy price of $2.95 an issue.

Mr./Mrs./Ms._____
please print full name

Company_____ Title_____

Address_____

City_____ State_____ Zip_____

Please add $2 per copy for postage in Canada and all other foreign countries. Allow 30 to 60 days for delivery of first issue. Your subscription may be tax deductible—please check with your accountant.

C_to_dBASE

The MISSING LINK

C_to_dBASE is a new development tool that allows you to manipulate dBASE data and index files with programs written in the C language. C_to_dBASE provides more than 70 C language functions including:

- Functions to access and modify dBASE data and index files without using dBASE.
- Powerful C language functions for development of dBASE file management programs.
- A menu-driven sample application program that demonstrates the use of C_to_dBASE.
- Full source code in C.
- No royalties.

Whether you are a beginning or professional programmer, C_to_dBASE is a powerful tool for the development of data base applications. Only $150.00 (includes source code).

For More Information Or To Order Call:

800-922-0169

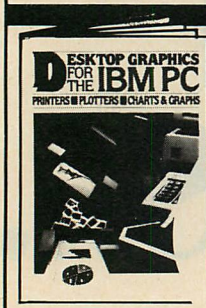
COMPUTER INNOVATIONS, INC.

980 Shrewsbury Avenue, Tinton Falls, NJ 07724

Prices are subject to change without notice.
dBASE is a trademark of Ashton-Tate.

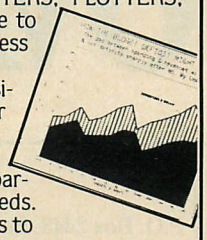
CIRCLE NO. 181 ON READER SERVICE CARD

USING?...BUYING?...UPGRADING?...



A GRAPHICS PACKAGE FOR YOUR PC!

You have to create graphs and charts to tell a story. Your needs vary from financial statements and personnel benefits to inventory records. Presentations are made on slides, printouts and monitors. You need a good and easy-to-manage graphics package. You need DESKTOP GRAPHICS FOR THE IBM PC: PRINTERS, PLOTTERS, CHARTS AND GRAPHS, the fully illustrated guide to the preparation, design and production of business graphics.



This book is written with you in mind—the business or professional user with little technical or statistical knowledge, using or planning to purchase a graphics package. You'll find out what charts are available to you...what data works best with each chart...what hardware options you have...and a comparison of the four leading software packages that will best meet your needs.

Author Corey Sandler gives you clear and non-technical introductions to graphics theory and statistics, making this seemingly impossible task, easy.

If you've been contemplating buying a new graphics package or you just want to do more with your current package, this book is for you!

For faster delivery, PHONE TOLL FREE 9 am-5 pm E.S.T.: 1-800-631-8112 (In NJ 201-540-0445).

Also available at your local bookstore or computer store.

CREATIVE COMPUTING PRESS
Department FC7C, 39 East Hanover Ave., Morris Plains, NJ 07950

Please send me _____ copies of DESKTOP GRAPHICS FOR THE IBM PC: PRINTERS, PLOTTERS, CHARTS AND GRAPHS at $14.95* plus $2.00 postage and handling ($5.00 outside USA) each. Item #60-7.

Payment Enclosed $_____.* Residents of CA, NJ and NY State add applicable sales tax.

Charge My: ☐ AmEx ☐ MC ☐ Visa

Card No._____ Exp. Date_____

Mr./Mrs./Ms._____
print full name

Address_____

City/State/Zip_____

☐ Please send free catalog.

tially released: XLT-86 from Digital Research, TRANS 86 from Sorcim, and the Z80 to 8086/88 translator from Seattle Computer. The translated 8086/88 assembly language code was then run through an 8086 assembler such as the IBM Assembler. This quick and dirty approach appears to have been widely used.

5. They could use a translator to produce a rough draft and then fine-tune the translated code through successive revisions. But assembly language programmers disagree as to whether this approach is any faster than a line-by-line translation. Both approaches, however, do require a great deal of programming effort, which may explain why neither was used.

Bloated code size, lack of speed, inability to use the 8088's expanded memory, and the constant stream of bugs are characteristic of the translator programs that were initially available for the PC. Users interested in detailed explanations about these translator programs can read "Upward Migration, Part 1: Translators" (Roger Taylor and Phil Lemmons, *Byte*, June 1982). The article provides comparisons of the technical problems and limitations in translating Z80 and 8080 assembly language into 8086/88 assembly language.

Regardless of the conversion method, the implementation problems remain. Inefficient conversion methods produce ineffective applications programs unless corrected.

Translators are of very limited value. The first such limitation stems from the fact that translators impose the limitations of the original CPU (Z80 and 8080) on the destination CPU (the 8086/88). For example, the 8088 has six registers that the Z80 does not have. Especially important are the four segment registers used by the 8088 for memory addressing. Since the Z80 does not have segment registers,

translated code does not directly use these registers. This is the main reason that translated code does not make an efficient use of the expanded memory on the 8088.

The second limited value is that the 8088 has a richer and more powerful instruction set than the 8080 or Z80, but translators do not make use of it. In the code fragment in figure 1, 20 instructions (32 bytes) for the 8080 become 21 instructions (42 bytes) for the 8088 when run through XLT-86. These 21 instructions can be reduced to 13 (26 bytes). This fragment can be used to indicate the bloat and inefficiency of translated code. The importance of the issue is made clearer when one considers that translated applications contain several thousand lines of source code.

Translated code is unnecessarily slow and it requires additional memory. Programs that run in 64KB of RAM on CP/M machines suddenly require 96KB to run on the PC. Such programs need the expanded memory of the 8088, but then cannot make further use of it.

The third limitation of translated software is that the translated 8088 code becomes what programmers refer to as "spaghetti code." Programs written originally in 8086 assembly language can adopt a modular approach using the strongly typed data structures in 8086 assembly language. Such programs are easier to debug and maintain. But translated code requires intimate knowledge of both Z80 and 8086 assembly languages to debug and maintain a program. Otherwise, repairing a bug in one section of the translated code may generate an unintended bug in another section.

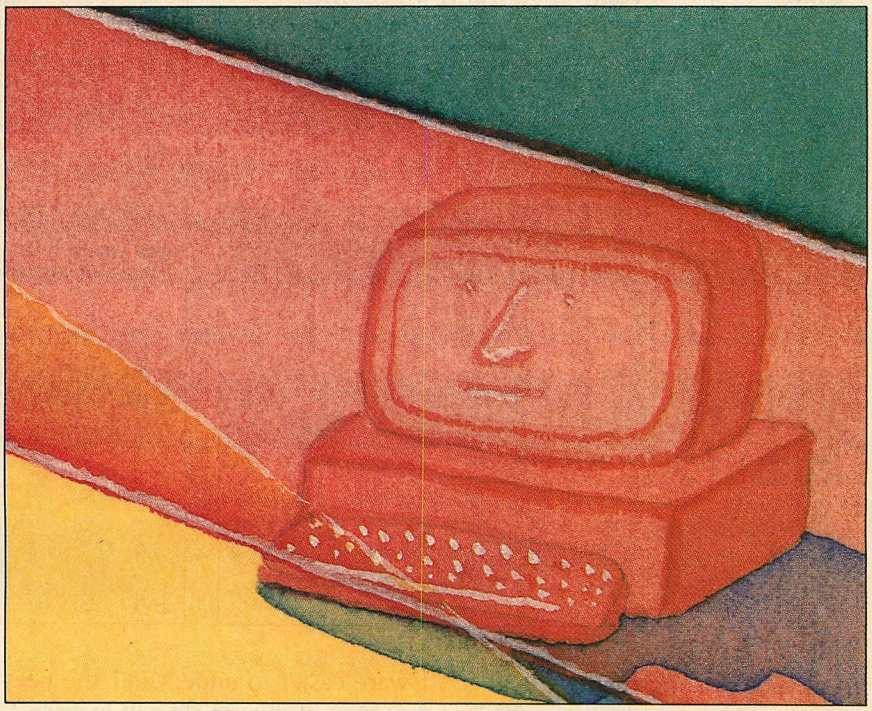
dBASE II can be interpreted as an example of this kind of problem given the length and complexity of the original program. Version 2.4 corrects 26 bugs in version 2.3D. Ashton-Tate has tied the bug corrections to the new features in each release, forcing users to pay a surcharge for the corrections regardless of whether they want the added features. The user can sidestep the problem by upgrading from dBASE II to dBASE III for $200.

Access to PC-specific features, such as the function keys, is the fourth limited value. For a year after the PC's introduction, patches for WordStar to implement the PC keyboard were published almost monthly. The PC also uses generous amounts of memory to map the screen in high memory, a feature that could not be used until version 3.3 of WordStar was released.

The fifth limitation is based on the use of PC-DOS. Under CP/M, if the disk in a drive is changed without hitting Ctrl-C, CP/M will display its famous B-DOS error. But it will not overwrite the directory. WordStar will do that under PC-DOS.

Translated software often has difficulty with features in DOS 2.0 that do not have a counterpart in CP/M. For example, suppose a user puts dBASE II with its support programs in a subdirectory on a fixed disk, then enters MD (make a directory) to create another subdirectory for database files. He is then unable to access both subdirectories from within dBASE II, which, like most software for the PC, can only access files in the current directory. Considerable rewriting of translated code is necessary to make such DOS 2.0 features work.

Difficulty in using the capacities of the 8087 is another limitation. In the CP/M world, packed decimal subroutines were not only easy to write, but were also seen as the only acceptable way to avoid round-off errors in business calculations. Translated packed decimal will work with the 8088, but requires a substantial reworking of the translated code to integrate the 8087's instruction set. Further, the 8087 supports the packed decimal (BCD) data type. The premium in clock cycles is high, however; the 8087's forte is floating-point arithmetic.



Writing floating-point subroutines for business calculations is a more substantial programming task than using packed decimal. It is possible, however, since some mainframe floating-point packages have been written in FORTRAN.

It is possible on the PC as well. VisiCorp expanded the DIF format

FIGURE 1: *Code Translation Examples*

The following code fragment concatenates a string of up to 44 characters in length that is located at the source onto the end of a string located at address BUFFER. The concatenation proceeds until a space character is encountered or until the maximum length is reached. When the transfer is complete, the routine then calculates the total length of the string.

8080 Example
20 instructions, 32 bytes

```
MOVEIT      LXI     H,SOURCE        ; point hl at source string
            LXI     B,BUFFER+20     ; point bc at destination
            MVI     D,44            ; maximum length on string @
MOVE1       MOV     A,M             ; get a byte
            CPI     20H             ; is it a space?
            JZ      ENDMOVE         ; yes, were finished
            STAX    B
            INX     H
            INX     B
            DCR     D
            JNZ     MOVE1
ENDMOVE     LXI     H,BUFFER
            MOV     A,C
            SUB     L
            MOV     L,A
            MOV     A,B
            SBB     H
            MOV     H,A
            XRA     A
            RET
```

8086 Example (translation done by XLT-86)
21 instructions, 42 bytes

```
moveit:         mov     bx,(offset source)
                mov     cx,(offset buffer+20)
                mov     dh,44
move1:          mov     al,byte ptr [bx]
                cmp     al,20h
                jz endmove

; extra instruction since cx can't be a memory pointer
; xlt86 moves its contents into si and uses si as the memory
; pointer
                mov     si,cx
                mov     [si],al
                inc     bx
                inc     cx
                dec     dh
                jnz     move1
endmove:  mov   bx,(offset buffer)
                mov     al,cl           ; notice that
                sub     al,bl           ; xlt86
                mov     bl,al           ; translates out
                mov     al,ch           ; the 16 bit subtraction
                sbb     al,bh           ; verbatim
                mov     bh,al
                xor     al,al
                ret
```

8086 Example 2 (a possible hand optimization of the above)
13 instructions, 26 bytes

```
                mov     si,(offset pgm:source)
                mov     di,(offset pgm:buffer+20)
                mov     cx,44
                cld
move1:    lodsb                 ; get a byte and advance si
                cmp     al,20h
                jz      endmove
                stosb                   ; store byte advance di
                loop    move1           ; loop untill cx = 0
                mov     si,(offset buffer)
                sub     di,si
                xor     al,al
                ret
```

to include floating point so that VisiTrend/Plot could use the 8087. Users can begin testing to see if VisiCorp has resolved the question of the use of floating-point arithmetic for business calculations. Spreadsheet analyses that use the exponent, square root, and logarithm could benefit from the speed and enhanced precision of the 8087. Sorcim, for example, could use Microsoft's recently released macro assembler, which contains the 8087 instruction set, to produce an accurate and powerful version of SuperCalc 3 that is able to use the 8087. But it would only run on an 8088/87 machine. Reverse translation is not possible.

WORDSTAR REWRITTEN FOR 8088 WORLD

To make these technical and rather abstract problems of translated software easier to understand, the next section of this article will include a hypothetical WordStar program, "rewritten" to take advantage of the 8088's chief additional resource—memory. It will be assumed that the memory has 256KB of RAM. But, instead of using some of that memory for a RAM disk, it will be used in the applications program to achieve speed and expanded functions.

Some other assumptions have to be made in this hypothetical version of WordStar. Whether the program were to be rewritten in native 8088 assembly language or in a higher level language would not matter. It is expected that the initial release would very likely have some bugs; new programs almost always do. These can be fixed later. Furthermore, it would not matter that Micropro has a responsibility to make one version of WordStar that will run on 64KB CP/M machines and a different and incompatible version that will run on PCs.

The rewritten program would discard WordStar's overlay files to increase program speed and avoid unnecessary wear and tear on the disks. Using DOS 2.0, the program would now require about 100KB of memory. The program code that looks for COMMAND.COM on drive A: would be removed; and code would be added that has the program search drives A: through D: before giving an error message. In this way, the user could have both a fixed and a RAM disk. The WordStar buffer could be expanded from 20KB to 64KB so that the program could handle large documents without constantly and slowly accessing the disk. A choice would be added to the installation program (WINSTALL.COM) to allow the user to

BACKUP. AND WHY PEOPLE DON'T.

An Introduction To InfoTools' BAKUP™: The First Intelligent, High-Speed Software Backup For Hard Disk Systems.

Backing up important business files from hard disk is a pain—because traditional backup solutions are slow, unselective and, too often, too expensive. That's why people too frequently just cross their fingers and hope for the best . . . and invite the worst.

The BAKUP Solution: First, It's Fast.

BAKUP, the first intelligent backup, restore, and cataloging software system, can save you from disaster by securing your critical data—fast. With BAKUP, the time-consuming copying of hard disk files to floppies is slashed by up to 2½ times over other alternatives. The first backup of a 10-megabyte disk takes less than half an hour—and after that, daily backup normally takes only minutes.

Second, It's Smart.

InfoTool's designers have backed up speed with intelligence—in an exceptionally easy-to-use, menu-driven system.

- Simply select what you want backed up, and BAKUP does it without further instructions—and BAKUP will tell you beforehand how long the process will take and how many diskettes you'll need.
- While securing your files, BAKUP creates a unique catalog that keeps track of where your files are—so when it comes to restoring, you simply browse through the catalog and mark the desired files; then BAKUP tells you which diskettes to insert.

The BAKUP Solution: $149.95 In Software, Not Thousands In Hardware.

InfoTools' BAKUP software system, for its user practicality, its management reporting capability, and its unusually low price, is a revolutionary alternative to streaming-tape hardware that can cost 10 to 15 times more. If you already have another file-oriented backup device such as a high-capacity floppy, nonstreaming tape, or removable cartridge drive, BAKUP will be a sensible addition for more speed and convenience.

Put An End To Risk-Taking With Our 30-Day, Money-Back Guarantee.

BAKUP is the right choice for IBM PC/XT, AT, or compatible systems with mass-storage management needs. And it's as easy and risk-free to get as it is to use. Just fill out the coupon below or call our toll-free order number. Use your VISA or MasterCard. If, within thirty days, you find it's not right for you, for any reason, we'll give you your money back. It's that simple. Dealers, OEMs, or corporate buyers should call (408) 725-1151 to inquire about our volume discounts.

So, uncross those fingers. Pick up a pen or a phone and order BAKUP today.

Okay, I Promise To Start Backing Up My Hard Disk Files.

Send me ____ copies of BAKUP, complete with documentation and diskette labels, at $149.95 each, backed by a 30-day money-back guarantee. Add $5.00 shipping and handling. In California, add sales tax.

Name _____
Title _____
Company _____
Address _____
City _____ State _____ Zip _____
Phone _____
VISA/MasterCard # _____
Expiration Date _____
Signature _____
☐ Check or money order enclosed.

INFOTOOLS
Steps Ahead In System Backup And Restore.

InfoTools
10044 S. DeAnza Blvd.
Cupertino, CA 95014
(408) 725-1151

Toll-free telephone for orders only.
6 AM to midnight (Pacific time)
In California call 1-800-672-3470 Ext. 801
Outside California 1-800-538-8157 Ext. 801

CIRCLE NO. 144 ON READER SERVICE CARD

specify how much memory is to be dedicated to the buffer. For example, an author using WordStar to write a book could specify 128KB or 192KB of memory.

Features would be added that allow the user to move quickly to the desired location in a manuscript when it is stored in memory. The program would be made to read the system clock so that the disk file would be updated every few minutes to save the user's work.

Every keyboard-specific feature would be used in this ideal version of WordStar. The control and alternate keys with the 10 function keys would implement 30 WordStar control sequences. The insert, delete, and cursor keys would be used to eliminate any unnecessary control sequences. However, the user still would have the option of the old control codes (in WINSTALL.COM) if he already knew them and did not want to learn new sequences.

The rewritten program would allow available memory to implement immediate tasks, so the overlay file for WINSTALL.COM could be deleted. Since the memory would be available, the print buffer could be made large enough to work as a background task.

The file upon which the user is currently working could be put on a drive other than the default drive. DOS 2.0 features would be added within the program so the user could specify the subdirectory where the print file could be found.

At the moment, all PC users who own WordStar share the same situation: they are using a program that does not make full use of their machines.

Since program size is not critical, certain features could be added—footnotes, index, and table of contents were available in the CP/M world only by purchasing separate WordStar support programs, such as Documate/Plus. Integrating such functions would allow the user to implement them while writing text on the screen.

Printer technology has greatly changed since WordStar was first introduced. Because size would not be a consideration in the hypothetical rewritten WordStar, the following changes could be incorporated:

1. All 256 ASCII characters could be

CIRCLE NO. 213 ON READER SERVICE CARD

Look to the Leader

I² has been delivering low-cost storage products since 1978

For affordable, expanded storage for your IBM PC or PC compatible, look to the leader—I² Interface, Inc. With I² Interface Winchester DiskSystems,© you can have levels of storage typically associated with larger, more expensive computer systems. Our DiskSystems are available with formatted storage capacities of 10, 15, 22, 33, 55, 87 and 119 megabytes. These DiskSystems are bootable from the Winchester on some PCs. Plus, I² Interface has more to offer:

- Internal-mounted Winchester system with 10 megabytes
- Removable cartridge DiskSystem with 10 megabytes
- Cartridge TapeSystems© with 10 to 60 megabytes
- Plus an array of other peripheral products

Internal Winchester DiskSystem

Cartridge TapeSystem

Simple and fully compatible

I² DiskSystems and TapeSystems are simple to install and have proven reliability. All are FCC Class B approved and undergo an extensive 48 hour test period prior to shipment. All are backed by a 90-day warranty that covers parts and labor with an extended one-year warranty available. I² Interface products are compatible with IBM PC, XT and portable models, plus other popular PC compatible computers.

See your dealer today to get the affordable means to expand the capabilities of your IBM PC and PC compatible. Look to the leaders—look to I² Interface.

Removable Cartridge DiskSystem

I² Interface, Inc.

21101 Osborne Street
Canoga Park, CA 91304
(818) 341-7914 Telex 662949 CNPK

IBM is a registered trademark of IBM Corporation
DiskSystems and TapeSystems are copyrights of I² Interface, Inc.

© 1984 I² Interface, Inc. All rights reserved
In Australia: Dick Smith Electronics (02) 888-3200

DEALER INQUIRIES CIRCLE NO. 149 ON READER SERVICE CARD

END USERS CIRCLE NO. 150 ON READER SERVICE CARD

C

Software Development

PCDOS/MSDOS

Complete C Compiler

- Full C per K&R
- Inline 8087 or Assembler Floating Point, Auto Select of 8087
- Full 1Mb Addressing for Code or Data
- Transcendental Functions
- ROMable Code
- Register Variables
- Supports Inline Assembler Code

MSDOS 1.1/2.0 Library Support

- All functions from K&R
- All DOS 2.0 Functions
- Auto Select of 1.1 or 2.0
- Program Chaining Using Exec
- Environment Available to Main

c-window™ Symbolic Debugger

- Source Code Display
- Variable Display & Alteration Using C Expressions
- Automatic Commands
- Multiple Breakpoints by Function & Line Number

8088/8086 Assembler

- FAST — Up to 4 times Faster than IBM Assembler
- Standard Intel Mnemonics
- Compatible with MSDOS Linker
- Supports Full Memory Model

8088 Software Development Package

$199.00

Includes: C Compiler/Library, c-window, and Assembler, plus Source Code for c-systems Print Utility

c-systems

P.O. Box 3253
Fullerton, CA 92634
714-637-5362

CIRCLE NO. 113 ON READER SERVICE CARD

printed on the screen. Also, the necessary conversions could be included in the printer drivers so that the printer could print both text and graphics within a single document.

2. Both micro and proportional spacing could be supported. Part of such support would have to be multiple horizontal and vertical indexes for different printers instead of the single index.
3. A pause command could be added that would enable the user to change print wheels anywhere in the text. Spare control codes could be added in the WINSTALL.COM program. Forty should be enough to install control codes for a color printer.
4. Codes could be added to delete all the WordStar control codes and then rename the straight ASCII file and save it back to disk. Such a disk could be given to a user with a different word processor so that he could edit and format it for his printer.

Users with different needs are likely to have a longer or shorter list for their ideal WordStar for the PC, depending on their needs. At the moment, all PC users who own WordStar share the same situation of having a program that does not make full use of their machines. By the way, the programs that have displaced WordStar use more than 64KB of memory. WordPerfect, for example, uses 128KB, and has all the features mentioned above.

dBASE II ON THE PC

dBASE II's Sort function will serve to illustrate some criticisms of translated code. The accepted wisdom, even among CP/M users, is to avoid the Sort function and use the faster Index function instead. Sorting, however, depends on the efficiency of the Sort algorithm and the amount of available memory. Since dBASE II does not use the expanded memory, the Sort function provides a fair test of translated software.

Using a 288KB dBASE II file with 1,545 records with 11 fields and 256KB of RAM, I compared sorting times for dBASE III and three other programs. All times are listed in hours, minutes, and seconds. These figures should be interpreted only as an indication of the importance of the present topic to users. The usefulness of dBASE II, for instance, cannot be reduced to the speed of its sort function. The elapsed times are shown in table 1.

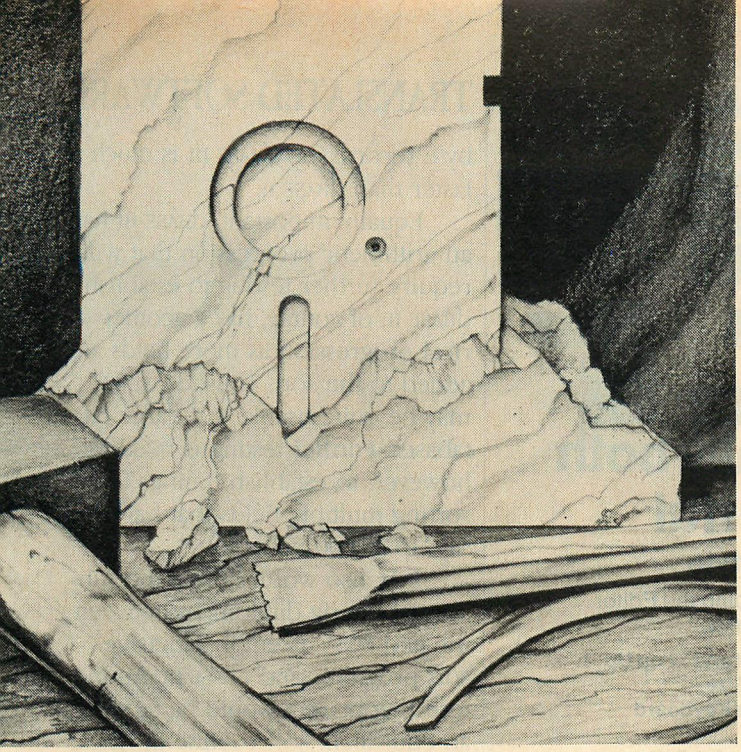
TABLE 1: *Elapsed Sorting Times—1,545 Records*

PROGRAM	ELAPSED TIME
dBASE II	01:34:14
DBPlus	00:06:44
Autosort/86	00:01:33
Opt-Tech Sort	00:01:15

(dBASE II churned the disk the entire time. The other 3 programs read the file in at least 64KB gulps, so disk access was minimal.)

DBPlus has been rewritten in C. It provides an interesting example of a case in which dBASE II is indicted by an ally, since DBPlus uses all available memory. Autosort and Opt-Tech Sort are written in 8086 assembly language, but the times are not directly comparable with dBASE II and DBPlus since neither program directly reads a dBASE II database file. For this test, the dBASE II file was manipulated until it was in a form Autosort and Opt-Tech Sort could read. These two programs were included to give a rough indication of what Ashton-Tate might be able to achieve if it rewrote dBASE II in 8088 assembly language. DBPlus provides a comparison of dBASE II with a program written in a higher level language, such as C or Pascal.

dBASE III was written entirely in C, so the speed restrictions built into the translated dBASE II code have been removed. It required 4 minutes 23 seconds to sort 1,589 189-byte records. It required 5 minutes 37 seconds to sort 2,459 189-



"In the art of programming the difference between greatness and mediocrity is often the quality of the artist's tools."

Praise From Professionals

"PolyLibrarian is a powerful tool for serious hobbyists and professional programmers. It is a thing of beauty; a work of art. The documentation is excellent, the large selection of commands are intuitive to learn and easy to use, and the program itself provides a service of inestimable value. It is refreshing to see a tool of this caliber available for serious programmers. The design of this program shows foresight and ingenuity. It sets the human engineering standard for programming utilities. If all of a programmer's tools were so simple to work with, better programs could be developed in less time and with fewer headaches. *Bravo, Polytron!* I look forward to your next product."

Dan Rollins,
Programmer and Author writing in PC Age

"PolyLibrarian is an extensive, friendly utility . . . an excellent tool for serious programmers. It combines professional quality with a flexible user interface."

Greg Estes
Editor, Programmers Journal

"I am thoroughly pleased [PolyLibrarian] is definitely one of the best products of its type that I have ever used on any system."
An Unsolicited Comment from
Steve Kauffman
Consulting Engineer

To Order or Request Literature Call

1-800-547-4000

Ask For Dept. 310
VISA & MasterCard Accepted
Or Send Checks, P.O.'s To:
Polytron Corporation DS-310-F1
P.O. Box 787, Hillsboro, OR 97123
Add $1.25 Shipping Charge For Each Product Ordered.

CIRCLE NO. 268 ON READER SERVICE CARD

POLYOVERLAY

Make Maximum Use of Memory with Overlay Code. Creates optimal memory overlay structures, in terms of utilizing a minimum of total physical memory, while it builds a batch file to automatically drive an overlay linker, for creating efficiently overlayed executable code. Creates optimum overlay structures for any modular language including C, FORTRAN, Pascal, Ada and even BASIC. Essential for porting mainframe code too large to fit into personal computer's memory all at one time. Requires MS-DOS 2.0, and Microsoft's Linker Version 2.4 Shipped with Users Manual **$99**

POLYTRON C LIBRARY 1

A Library of High-Performance Functions for Lattice C Compiler Users. Over 50 significant routines more useful than common library functions. The library includes UNIX-like utility functions, file management functions, more efficient and flexible I/O routines, and executive functions. This is a powerful, professional-quality C library that is easy to use and designed to increase your productivity. Assembly and C source code included. Requires Lattice C Compiler Includes Users Manual..... **$99**

POLYLIBRARIAN

The Object Module Library Manager for MS-DOS™. PolyLibrarian lets you create a single library from related Objects Modules. The IBM PC Linker will then select only the modules necessary to produce an executable file. PolyLibrarian can: Create, organize, reconstruct, dissect, and compress libraries of object code modules. Add, delete and replace an object module. Extract a module from a library to create an OBJ file. Change public and external names. Modules are time-stamped within the library. Supports full path names. Supports Microsoft's original and latest Linker (Version 2.4). Includes installation program to customize options to your specific needs. Features three Modes of Operation (Interactive, Command File, Command Line) that can be freely intermixed. Surpasses performance of other primitive librarians. Features a highly functional user interface that uses simple meaningful key words. Requires 128K RAM, MS-DOS (PC-DOS) 1.1 or 2.0. Compatible with any compiler or assembler that uses the MS-DOS (PC-DOS) Linker. Shipped with comprehensive Users Manual including step-by-step tutorial for **$99**

POLYLIBRARIAN II

Extends PolyLibrarian's power to Intel™ and Digital Research™ Format Libraries. PolyLibrarian II is an enhanced version of PolyLibrarian. In addition to all the features and functions listed above for PolyLibrarian, this version adds a new dimension of productivity for programmers using Intel and Digital Research Language Products. Compatible with any Intel Format Library and any Microsoft Format Library. Compatible with Intel's Link 86 under MS-DOS. Compatible with Digital Research Linker under MS-DOS **$149**

POLYMAKE

The Intelligent Program Builder & Maintenance Tool for MS-DOS. PolyMake frees you from the need to remember which files depend on others and which files have been modified. PolyMake will: Remember the exact sequence of operations necessary to make a new version of a program. This will significantly reduce developement time, prevent bugs & manage large software projects. Automatically invoke your compiler, assembler, linker, librarian, or do whatever is necessary to bring all dependent files up to date. Compare the date and time of all relevant files and use internal rules to rebuild a program or complete software system. Rules can be modified and expanded. Extensive debug capabilities help construct efficient make files. Includes features superior to UNIX Make. Fully automatic operation under MS-DOS 2.0. Full path name capabilities under MS-DOS 2.0. Requires 128K. Shipped with a comprehensive Users Manual **$99**

POLYFORTRAN TOOLS 1

Four Powerful Utilities in One Package. For developing or enhancing software or porting mainframe software to personal computers these easy-to-use tools will become indepensible for the professional FORTRAN programmer. Includes: 1. **FORTRAN-XREF** for developing comprehensive cross-reference maps of FORTRAN source code. Mainframe users expect this kind of utility. Now personal computer users have X-REF power. 2. **FORTRAN-EXTRACT** extracts the MAIN routine as well as all SUBROUTINES, FUNCTIONS and BLOCKDATAS from FORTRAN source code. It is unsurpassed for breaking-up large codes into manageable modules that can be individually modified, compiled, added to libraries and finally linked into a single executable code. 3.**FORTRAN-CLEANUP** performs three critical functions to improve FORTRAN source code readability: A. Renumbers FORTRAN source code statements within each routine to begin at a user specified starting number; B. Adds spaces around delimiters and key words; C. Performs indentation for DO loops, IF...Then and similar structures. If you are becoming weary of cleaning up "sloppy" code then you need FORTRAN-CLEANUP. 4. **FORTRAN-SCREEN** lets you show off your software. This is a complete set of FORTRAN callable screen attribute and cursor position control functions for creating user friendly, interactive menus and displays. Requires MS-DOS 2.0, 256K, One Disk Drive, Compatible w/hard disk. Shipped with Users Manual **$179**

M

POLYTRON

BRIEF

Program Editing is finally both Intuitive *and* Powerful

. . . and configurable to suit your style

BRIEF lets you concentrate on programming by keeping the Editor "out of the way," while combining power and natural flow:

- **Full UNDO (N TImes)**
- **Edit Multiple Large Files**
- **True Automatic Indent for C**
- **Exit to DOS Inside BRIEF**
- **Uses All Available Memory**
- **Intuitive Commands**
- **Tutorial**
- **Repeat Keystroke Sequences**
- **Windows (Tiled and "Pop Up")**
- **Unlimited File Size**
- **Reconfigurable Keyboard**
- **Online Help**
- **Search for Complex Patterns**
- **Mnemonic Key Assignments**
- **Horizontal Scrolling**
- **Comprehensive Error Recovery**

PLUS a Complete, Powerful, Readable, Compiled MACRO Language

Availability: PCDOS-compatible systems. **Price:** Only $195.
Win $1,000 and recognition for the Outstanding Practical BRIEF Macro. Other awards to be given.

Try BRIEF. Use the Demo . . . or the full product for 30 days. Call or write us . . . 617-659-1571

BRIEF is a trademark of UnderWare.
Solution Systems is a trademark of Solution Systems.

Solution Systems™

335- P Washington St., Norwell, MA 02061

CIRCLE NO. 239 ON READER SERVICE CARD

Introducing C.I.A. Data Security System

A Data Security system is only as secure as its users allow it to be. The method of protection should be complex, such that any method of attack on the files of the system will be expensive in terms of time and equipment. Our Solution . . .

- ★ The *D.E.S. Algorithm* (Data Encryption Standard) as proposed by the Federal Government, implemented in a Software version and modified by personalized coding tables, unique for each **C.I.A.** Program.
- ★ *A File* oriented system with different Access Levels to meet the special requirements of different Users.
- ★ *An Automatic Audit System* for each file and each User.
- ★ A Mandatory Password Procedure To Access: The System.
- ★ *A Maintenance System* accessible only by *One Person*, the *System Administrator.*
- ★ *Our Own Algorithm* which converts any *File To a Protected Hidden File*, with no *File Name* in any Directory.
- ★ *Our Own Protection System* which prevents any *User* from *Erasing Or Deleting A File* protected by the **CIA** program.

All the above features, and more, are included in the **CIA** program which runs on any IBM-compatible *Computer* with 256K of Memory. The **CIA** Program, partially encrypted, is written in C Language, in a compiled executable form, fully protected.

In fact the above is all that a User has to know about the **CIA** Program!!

CIA

Computer Intelligence Access

Introductory Price $129

OPTIONS
READ ONLY
WRITE
NO PRINT
COPY
MODEM OFF
CHANGE
ENCRYPTION
AUDIT
NETWORK

MasterCard

GENERAL DATA SECURITY SYSTEMS, INC.
1127 Loma Ave. • Long Beach, CA 90804
(213) 494-1127

VISA

CIRCLE NO. 140 ON READER SERVICE CARD

byte records. So dBASE III is much faster than dBASE II.

Equally important, dBASE III has an arithmetic progression that will require further testing to establish. dBASE II, of course, has a geometrical progression as more fields are added to the sort. Thus, dBASE III may be quite usable with large databases. Further testing is needed, however, to establish timings for sorting multiple fields that have, say, 10-20,000 fields.

It is also worth noting the substantial timing differences between the two 8086 assembly language sort programs and dBASE III. An interesting project would be to write an equivalent sort routine in Pascal and FORTRAN and compare the timings with those from the C version. C has a reputation as a fast, portable, high-level assembly language. Whether C compilers available for the 8086 do enough optimization to warrant this reputation is an unresolved question. The UNIX C compiler requires seven passes to achieve optimization.

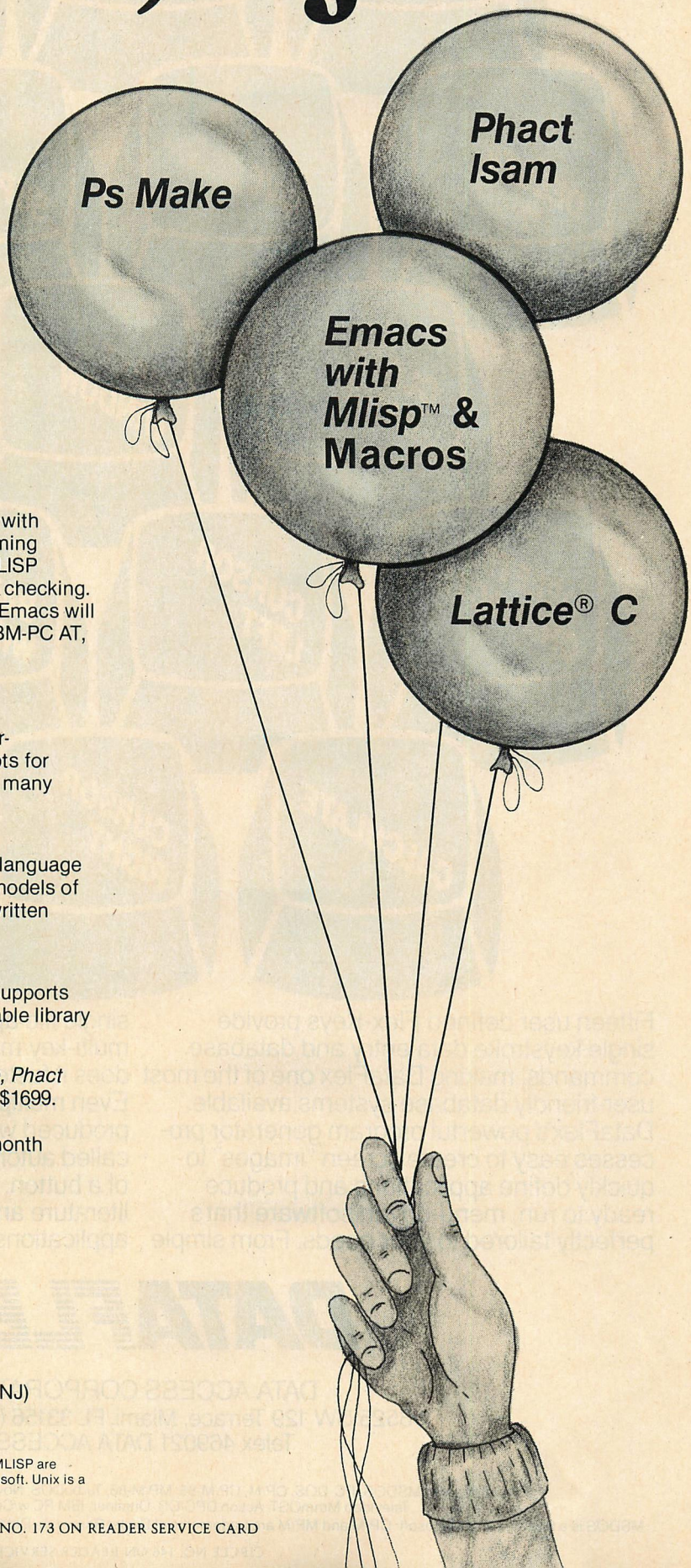
TABLE 2: *Elapsed Sorting Times—65,000 Records*

PROGRAM	ELAPSED TIME
dBASE II	44 hours
DBPlus	4½ hours
Autosort/86M	1 hour
Opt-Tech Sort	48 minutes

Many users assume that dBASE II's theoretical limit of 65,000 records provides them with all the future expansion they need. Thus, the figures in table 2 are offered as a rough approximation of how long dBASE II would take to sort 65,000 records, as compared to the other three programs. A simple arithmetic progression was used in calculating these times: the time required to sort 1,545 records was multiplied by 10. This figure was then multiplied by 4 to get the approximate time for 62,000 records. Therefore, my times are likely to be favorable.

Hackers, rejoice!

Finally, a programmable multi-window editor for MS-DOS.™



EMACS

UniPress EMACS™
famed Gosling version. Multi-window, text editor with extensibility through the built-in MLISP programming language and macros. Dozens of source code MLISP functions; including C, Pascal and MLISP syntax checking. Run Lattice C or PsMake in the background and Emacs will point to any errors. EMACS now runs on TI-PC, IBM-PC AT, DEC RAINBOW or any MS-DOS machine.

PsMake
UNIX style 'make' utility, includes facilities for automatically rebuilding programs based on inter-dependencies of the modules. Includes rule scripts for many popular MS-DOS languages. Also includes many UNIX style tools (ls, cat, touch, etc).

Lattice C
'the' C compiler for the serious developer. Full C language producing the best code for the 8086 family. All models of 8086 supported. Emacs, PsMake, and Phact all written using Lattice.

Phact Isam
multi-key ISAM for MS-DOS. Uses b + tree, and supports variable length records. Includes full Lattice linkable library and high-level functions.

FULL SYSTEM *(includes Emacs (object), PsMake, Phact Isam & Lattice C)* — $1099, with EMACS source, $1699.
STANDALONE: EMACS $375, with source $995.
Lattice $425. PHACT $250. PSMAKE $159. One month EMACS trial $75.

EMACS PRICE INCREASE FEB. 1
BE SURE TO PLACE YOUR ORDER NOW!

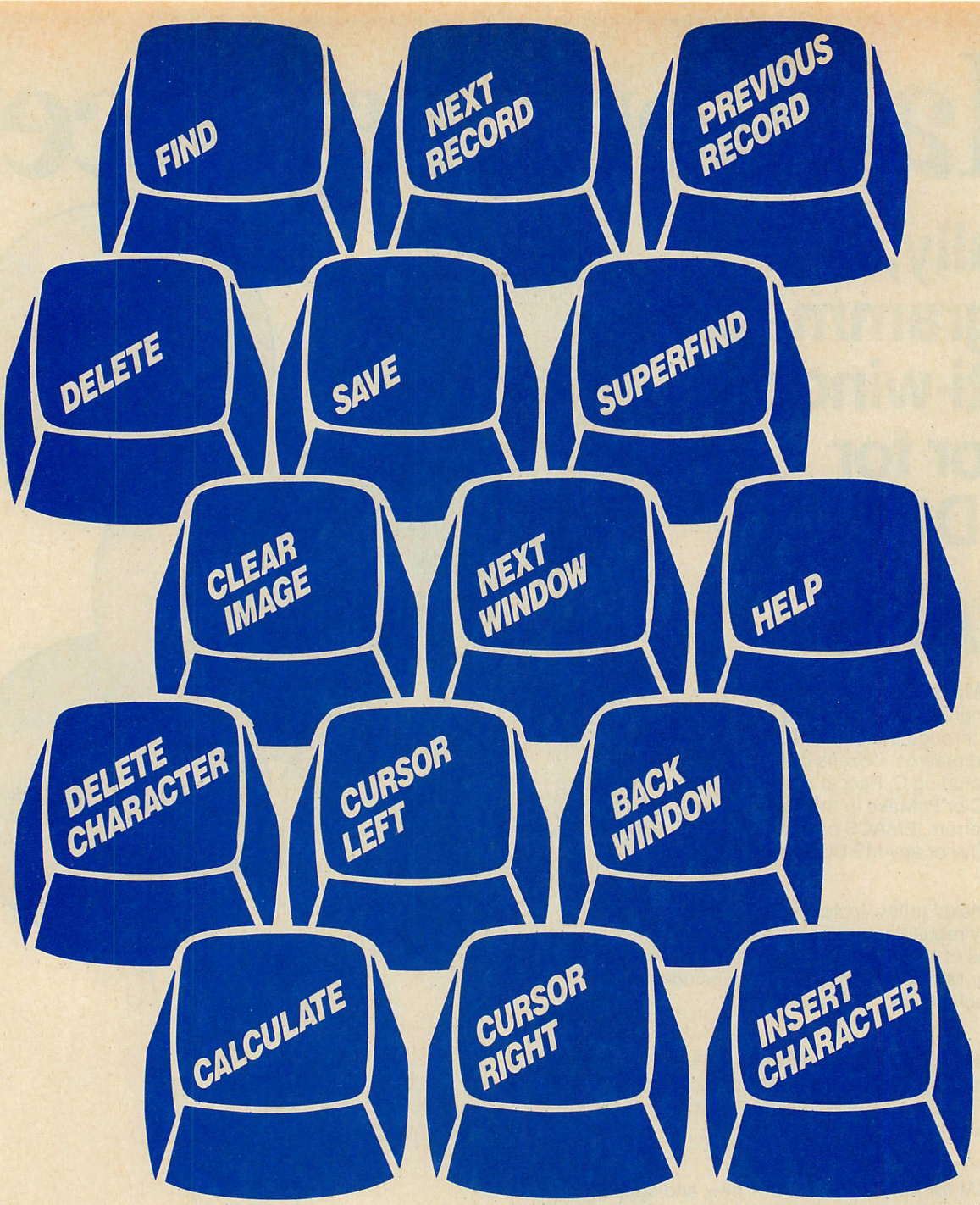
UniPress is a major publisher of Unix Software.
Call or write for more information.

UniPress Software, Inc.

2025 Lincoln Highway, Edison, NJ 08817
201-985-8000 • Order Desk: 800-222-0550 (outside NJ)
Telex: 709418 • Mastercard and Visa
Japanese Distributor: SofTec Tel.: 0480 (85) 6565

Lattice is a registered trademark of Lattice, Inc. UniPress Emacs and MLISP are trademarks of UniPress Software, Inc. MS-DOS is a trademark of Microsoft. Unix is a trademark of Bell Laboratories.

CIRCLE NO. 173 ON READER SERVICE CARD



Fifteen user defined Flex-Keys provide single keystroke data entry and database commands, making DataFlex one of the most user-friendly database systems available. DataFlex's powerful program generator processes easy to create screen "images" to quickly define applications and produce ready to run, menu-driven software that's perfectly tailored to your needs. From simple single file applications to complex multi-file/ multi-key/multi-indexed systems, nothing does it faster, better or easier than DataFlex. Even multiple page HELP screens are produced with a one word command and called automatically at literally, the touch of a button. Call or write today for our latest literature and a list of existing DataFlex applications.

DATAFLEX™

DATA ACCESS CORPORATION.
8525 SW 129 Terrace, Miami, FL 33156 (305) 238-0012
Telex 469021 DATA ACCESS CI

compatible with MSDOS, PC-DOS, CP/M, CP/M-86, MP/M-86, TurboDOS, Novell Sharenet, PC-Net, Molecular N-Star, Televideo MmmOST, Action DPC/OS, Onminet, IBM PC w/Corvus and OSM Muse.
MSDOS is a trademark of Microsoft. CP/M and MP/M are trademarks of Digital Research. DataFlex and FlexKeys are trademarks of Data Access Corp.

CIRCLE NO. 146 ON READER SERVICE CARD

CP/M versions of dBASE II have proved that a geometric rather than an arithmetic progression is the case. For example, if 1,000 records can be sorted in 1 hour, 2,000 records would be sorted in 3 hours—not the 2 hours an arithmetic progression assumes.

QUEST FOR EL DORADO

The prevalent alternative to translators has been to write source code in a higher level language. When a compiler for a new CPU for that higher-level language is developed, the source code can be recompiled and the application can be remarketed. Generic, but copyrighted, software that works well on many different machines is the ultimate goal. Portability is the computer industry's current buzz word.

This approach has some problems. The IBM BASIC compiler has yet to catch up with the many features added to BASIC and DOS 2.0. Further additions have been made to BASIC for the PC*jr*. And, of course, applications programs are still restricted to the 64KB of data and 64KB of code built into the original compiler. As compilers are expanded, debugged, and given new features, the applications programs can expand as well.

The current rush is to convert applications programs to the C language. Application houses, including CP/M houses, are feverishly rewriting their applications in C with the expectation that C will be the Esperanto of computer languages. They seem to believe that C will be the universal language for all applications, for every CPU, and for every operating system. Whether C will bring them to El Dorado remains to be seen. C may be only the latest in a series of languages that were initially seen as universal solutions to complex problems.

More to the point for users interested in applications is the time required to write a full C compiler. Full C compilers started appearing

"Ouvrez les fenêtres!"*

Introducing MATIS™, the powerful new developmental system from France.

A complete and meticulously detailed program to make a programmer's work easier, faster, and . . . but of course . . . *better.*

☐ Window Management Systems ☐ Screen Generator ☐ Expanded Basic Commands ☐ Can be accessed from other languages ☐ 100% Assembler ☐ Automatic Scrolling in Windows ☐ Virtual Page larger than screen (up to 65534 rows x 65534 columns) ☐ Save or Print Pages ☐ MS-DOS ☐ 170 Page Manual (In *English* Mon Ami!) ☐ Only $150.

ORDER BY MAIL—WRITE OR CALL FOR COMPLETE DESCRIPTION
No license fee.

Softway, Inc.

500 Sutter Street • Suite 222–1A • San Francisco, CA 94102
Tel: (415) 397-4666 Telex: 880857

***"Open the windows!"**

CIRCLE NO. 176 ON READER SERVICE CARD

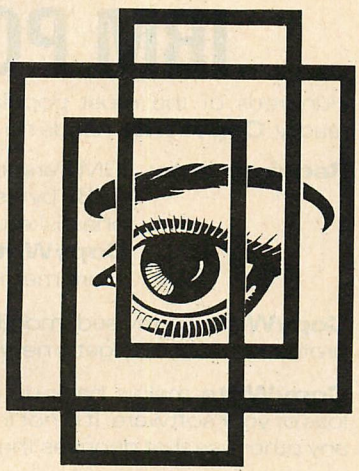
C the world from the Lattice perspective.

As a program designer, you know that it's essential to establish the right perspective. If you've chosen the C language perspective, then why not join the many professionals who use the Lattice family of C compilers and associated tool kits?

Our compilers provide the complete C language and the portable UNIX function library across a broad range, including MS-DOS, PC-DOS, CP/M-86, CP/M-80, and a variety of 68000 environments. Our cross-compilers operate on VAX/VMS, IBM/MVS, and all UNIX systems.

More than three dozen tool kits are available from us and other vendors, providing capabilities such as graphics, databases, CRT forms entry, and window management. No more need to re-invent the wheel for each application!

Contact us to learn more about the Lattice perspective on C program development.



LATTICE®

P.O. Box 3072
Glen Ellyn, IL 60138
312/858-7950
TWX 910-291-2190

CIRCLE NO. 128 ON READER SERVICE CARD

New Release
4.1

We've continually improved Microstat since it was introduced in 1978, and the latest release includes many new features you've wanted.

- Interactive and Batch Processing
- Expanded Data Management Subsystem with New Data Transforms
- Reading data files created by other programs
- 3 types of Analysis of Variance
- Time Series
- Crosstabs and Chi-Square
- Factorials, Permutations, and Combinations
- Hypothesis Tests
- Data sets that can exceed memory
- Multiple Regression (including Stepwise)
- Scatterplots (including best fit regression)
- Correlation Analysis
- 12 Nonparametric tests
- 8 Probability Distributions
- Descriptive Statistics
- Easy Installation

Microstat's algorithms have been designed to prevent numeric overflow errors and yield unsurpassed accuracy. Microstat's price is $375.00 including the user's manual and is available for the Z80, 8086, 8088 CPU's and CP/M80, CP/M86, MS-DOS, and PC-DOS. To order, call or write.

ECOSOFT INC.

6413 N. College Ave. • Indianapolis, IN 46220
(317) 255-6476

VISA MasterCard

Trademarks: Microstat (Ecosoft), CP/M (Digital Research), MS-DOS (Microsoft), PC-DOS (IBM), Z80 (Zilog), 8086, 8088 (Intel).

CIRCLE NO. 109 ON READER SERVICE CARD

CopyWrite backs up IBM PC Software

Hundreds of the most popular copy-protected programs are copied readily. **CopyWrite** needs no complicated parameters.

Requirements: IBM Personal Computer or XT.
128k bytes of memory.
one diskette drive.
CopyWrite will run faster with more memory or another drive.

CopyWrite is revised monthly, to keep up with the latest in copy protection. You may get a new edition at any time for a $15 trade in fee.

CopyWrite makes back up copies to protect you against accidental loss of your software. It is not for producing copies for sale or trade, or for any other use that deprives the author of payment for his work.

To order **CopyWrite**, call with your credit card or mail a check for $50 US funds to:

Quaid Software Limited
45 Charles Street East, Sixth Floor
Toronto, Ontario, Canada M4Y 1S2
Telephone (416) 961-8243

Ask about **ZeroDisk** to run copy-protected software from a hard disk.

CIRCLE NO. 194 ON READER SERVICE CARD

in early 1981. Four years later many of these compilers still lack libraries of full mathematical functions. Others are still restricted to 64KB of data and 64KB of code. Few of them yet support DOS 2.0 functions, such as redirection of input and output. Few yet include 8087 support. Perhaps after these problems have been resolved, large-scale applications programs, written in C, will be developed for the PC.

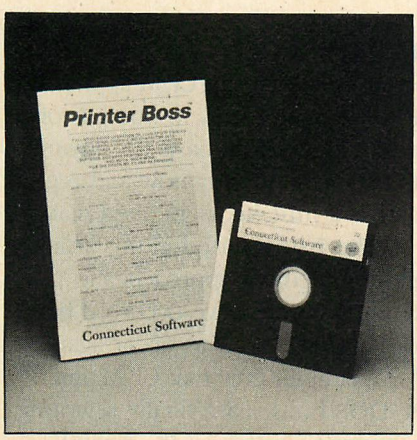
An application written in C that seems to work equally as well on CP/M and PC-DOS machines is The Word Plus from Oasis Systems. One reason that The Word Plus works well in both environments is that it strictly follows the ideas Kernighan and Plauger outlined in their book, *Software Tools*, more than a decade ago. Their approach stressed that software tools should be designed for specific tasks in order to keep the tools small in size, flexible to use, and easy to maintain. Therefore, The Word Plus contains 12 .COM files for separate tasks.

Each file, except for the dictionary, is less than 9KB. Because the programs are small and modular, they are easier to port and debug on another machine. The fact that the programs are small does not make them dependent on the amount of available memory. For example, if all 12 functions were integrated into a single program, The Word Plus would run only on an IBM or larger machine.

Since each program performs one task, a variety of task-specific options are available to provide flexibility. The spelling checker program has nine options, including one to install the other eight options permanently in a file. Another program, REVIEW.COM, has 10 options. This approach sits in marked contrast to the integrated omnibus packages, such as Lotus 1-2-3, Framework, and Context MBA, currently in fashion. The question remains as to whether such packages can integrate multi-

Printer Boss™

Letter quality printing, sideways printing, RAM printer buffer, 5 alternate IBM character sets, graphics, Greek and screen symbols, custom font design, high-speed character-mode output and full control of your Epson printer on one plain-English menu.



Now you can have all of these features and more for your Epson MX, FX, RX, JX and LQ-1500 printers. And all at the touch of a few keys. Printer Boss™ software is simply the ultimate in printer control!

Print letter quality on your FX printer at full text-mode speed using our unique two-pass dot-matrix approach. Use this **high-speed technique** to overprint dots which fit precisely between the dots in the standard characters, filling in the annoying spaces and greatly enhancing readability while avoiding the smearing effect of doublestrike or other print modes. Or print graphics-mode letter quality on the MX, RX and JX printers.

Print multi-page spreadsheets or reports as wide as you like, **sideways on your paper,** in a choice of five different type sizes, with automatic pagination both vertically and horizontally, at high speed and on any Epson printer.

Create a **RAM printer buffer** of from 1 to 32K, so you can print in background while using your PC for other work. Buffer your normal, letter quality or sideways printing for higher efficiency and throughput.

Download any of **5 different IBM character sets,** including the Matrix, Graphics 1 and Graphics 2 printer sets, the Screen set and the APL set. Use IBM block and line graphics characters, IBM screen characters, Greek and APL symbols on any Epson printer. Printer Boss™ is ideal for IBM graphics software and for **screen dumps.**

Or **custom-design your own character font** using our new font design feature, and build a library of your own fonts for future use.

Printer Boss™ also allows **full menu-based operation** of all control functions of all of the Epson printers. Select and deselect pica, elite, compressed, italic, enlarged, emphasized, doublestrike, underline, superscript and subscript for scores of different type faces. Switch the LQ-1500 between draft and letter quality.

Set line spacing, right and left margins and skip-over-perforation. Load USA, France, Germany, England, Denmark, Sweden, Italy, Spain and Japan langauge sets. **Control** unidirectional, half-speed and proportionally-spaced printing. **Store** and retrieve 10 complete menu settings with a few keystrokes. **Emulate** the IBM-label printer for the IBM-PC.

Print **samples** from the menu, or use program modules provided for printing ASCII tables and spreadsheet and text samples. **Create ASCII files of data,** corresponding to the stored menu settings, which can be accessed by or included in your own programs to set up the printer as you wish.

Printer Boss provides all of the above features on **one easy-to-use menu,** and it's compatible and extremely useful with such word processing and spreadsheet programs as **Wordstar, Lotus 1-2-3, Visicalc** and many, many others. The package is streamlined, professional and intended for serious work by seasoned PC users, but is **easily operable by the neophyte.** As a primary objective the development team designed the menu and its operation to minimize mental effort and fatigue in printer set-up and operation, which is particularly important for the newcomer to computers.

Printer Boss™ runs on the IBM-PC, IBM-PCjr, IBM-XT or any compatibles; PC-DOS 1.1, 2.0, 2.1 or equivalent; double-sided disk drive; 128K RAM; Epson MX, FX, RX, JX or LQ-1500 printers or compatibles.

Printer Boss™ $59.95. With Letter Quality or Sideline™ options $99.95. With both $139.95. **Demo disk** $10.00 credited to order. VISA, MC, or send check. Free info. Dealers welcome, sales kit available.

YES! PLEASE SEND PRINTER BOSS TODAY!

CONFIGURATION:
( ) PRINTER BOSS $59.95
( ) WITH SIDELINE OPTION $99.90
( ) DEMO DISK $10.00
( ) WITH LETTERBOSS OPTION $99.90
( ) WITH BOTH OPTIONS $139.85

ADD $2.00 SHIPPING ALL ORDERS. CONNECTICUT RESIDENTS ADD 7.5%. OUTSIDE USA AND CANADA ADD $15.00. COD ADD $2.00. PURCHASE ORDERS ACCEPTED.

PAYMENT: $_____
( ) CHECK ENCLOSED
( ) MONEY ORDER ENCLOSED
( ) COD
( ) VISA CARD ( ) MASTERCARD
CARD #: _____-_____-_____-_____
EXPIRES: _____
SIGNATURE: _____
DATE: _____

NAME: _____
COMPANY: _____
ADDRESS: _____
CITY/STATE/ZIP: _____
TELEPHONE: _____

Printer Boss™

CONNECTICUT SOFTWARE
30 WILSON AVENUE
ROWAYTON, CT 06853

INFORMATION:
203-838-1844

ORDERS ONLY:
800-826-1589

CIRCLE NO. 235 ON READER SERVICE CARD

MULTI-TASKING for the IBM AT!

also for the IBM PC or XT with MULTI-JOB™

"MULTI-JOB the most cost effective choice for the user with a need for multi-tasking." PC Age Vol. 3.8

With MULTI-JOB software up to 9 IBM PC DOS compatible programs can be running at the same time. Example, have your communication program running in the background, and still be using your word processing, spreadsheet programs, etc., at the same time! The keyboard and screen can be assigned to any job with a simple keystroke. The remaining jobs will continue to run unattended. With the many different options, MULTI-JOB is a very powerful package.

* No special hardware is required.
* Allows priorities to be given between each job.
* Programs can be run simultaneously or one at a time.
* 30-day free trial period.

MULTI-JOB	$159.00
ELECTRONIC DISK	$ 49.00
SPOOL PROGRAM	$ 24.00
SET MEMORY UTILITY	$ 24.00

B&L COMPUTER CONSULTANTS, 7337 Northview, Suite B, Boise, ID 83704, (208) 377-8088.

MasterCard VISA

Dealer's inquiries are welcome. Call or write for a free catalog.

CIRCLE NO. 153 ON READER SERVICE CARD

Now With Flipscreen

SYMD

SYMBOLIC•DEBUGGER

Faster, easier more productive

SYMD is a unique new programming aid that dramatically reduces the time and effort needed to identify and correct programming errors. SYMD simplifies debugging by utilizing source code symbols and line numbers wherever an address or offset is required. Flipscreen feature allows separate display, including graphics, for SYMD and program under test. SYMD also lets you: Examine and/or change real number data; assign permanent or temporary breakpoints, including pass counts to control looping; check instruction execution sequences with backtrace commands; use profiling commands to identify the most active parts of a program. And much more. SYMD can be used with compiler or assembly language programs. System requirements: PC-DOS™ or MS-DOS™ 1.1 or 2.0; 192K recommended; 80-column display.

SYMD is priced at only $125. Free literature on request. VISA or MasterCard accepted.

™MS-DOS is a trademark of Microsoft Corporation. ™PC-DOS is a trademark of the IBM Corporation.

D+V Systems
400 Amherst Street Nashua, NH 03063 (603) 881-7140

CIRCLE NO. 131 ON READER SERVICE CARD

TRANSLATED SOFTWARE

ple functions as well as single programs designed for a specific task.

REMAIN WARY

The reputation of a CP/M application, no matter how justified, is often an inadequate basis for buying its IBM version. Buy now and regret later is a mistake users often make.

The issues raised in this article about expedient approaches to marketing software have occurred before and are likely to occur again. For example, now that CP/M and PC-DOS houses are finally rewriting software that uses all PC capabilities, Apple's Macintosh owners can look forward to yet another round of translated software. Translators and cross-assemblers are quickly being released to produce 8086-to-68000 software. It is ironic that Macintosh owners are now about to suffer the same fate that PC users have had to endure for three years and only now are in the process of being freed from.

In retrospect, translators provided a quick fix when software for the PC was sparse. The trade-off between expediency and quality seems to have been quite high. Once translated software has been accepted by users, little incentive remains to redo it. For example, IBM announced PC*jr* with the original IBM BASIC compiler.

The least common denominator approach is not likely to disappear—even for software originating in the PC-DOS market. Some of the PC's competitors have keyboards with a conflicting arrangement of function keys. It is easier and more profitable for software houses to use the Esc key, found on every machine, rather than a machine-specific function key. By programming for a universal machine, only one inventory of disks and manuals must be maintained.

In an ideal world the needs of software houses and users would coincide. Until then users will have to remain wary and informed.

THE BRIEFCASE DATA BASE.

CARTRIDGE DATA MANAGEMENT COMES OF AGE.

Today's business microcomputers have generated an information explosion that today's data storage devices—including the highly-touted, high-capacity Winchesters—have been ill-prepared to contain.

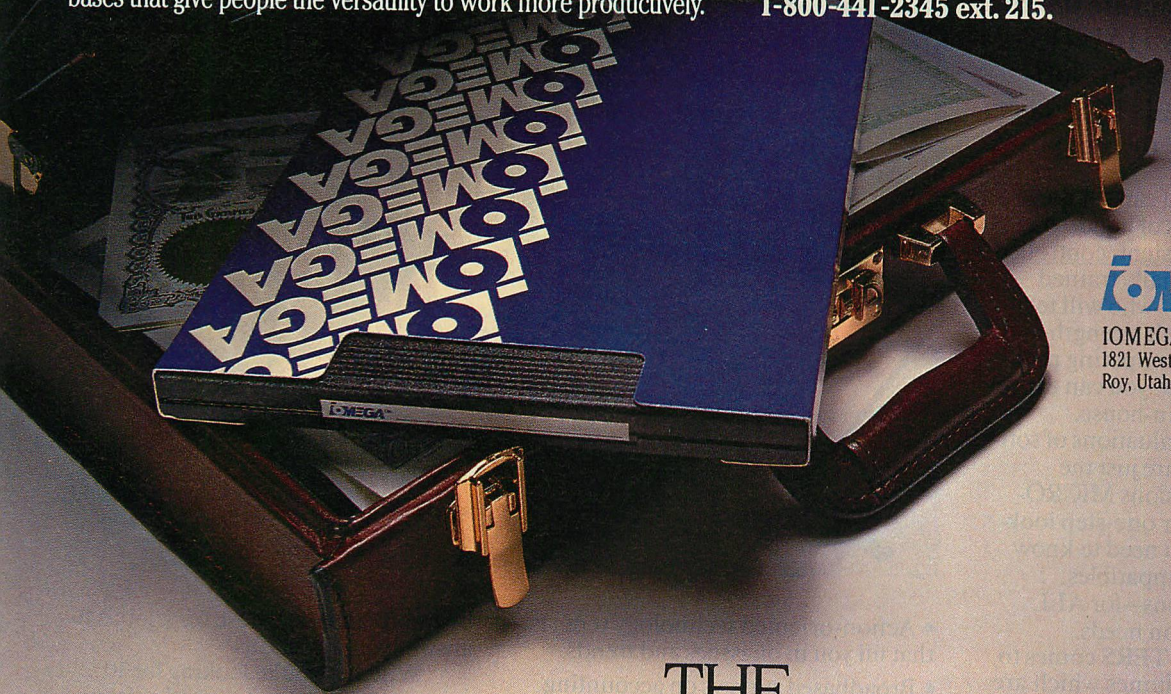
With one notable exception. The Bernoulli Box™ from IOMEGA. With its removable 10 megabyte cartridges and its proprietary flexible disk technology, The Bernoulli Box delivers unparalleled data base dynamics.

And that, more and more, is what your business needs today. Not centralized, monolithic banks of information, but data bases defined by job function and software application. Data bases that give people the versatility to work more productively.

But there is more. More performance and reliability. Transfer rates and access times faster than most Winchesters. No head crashes ever. And cost per megabyte that Winchesters cannot touch.

The Bernoulli Box's cartridge capacity, portability, and absolute interchangeability give your business more options. You can easily build primary data bases. You can package individualized data bases, software and all—for payroll, accounting, marketing—in convenient, dedicated cartridges. You can secure them quickly and economically in backup. And you can pack all of the data into a briefcase, an interoffice envelope, or even a file drawer.

The Bernoulli Box. For the IBM PC, XT, most compatibles and the TI Professional. **For the dealer nearest you, call 1-800-556-1234 ext. 215. In California call 1-800-441-2345 ext. 215.**



IOMEGA™

IOMEGA Corporation
1821 West 4000 South
Roy, Utah 84067

THE BERNOULLI BOX™

CIRCLE NO. 102 ON READER SERVICE CARD

"I waste a lot of time contacting vendors and then find out they don't have what I need."

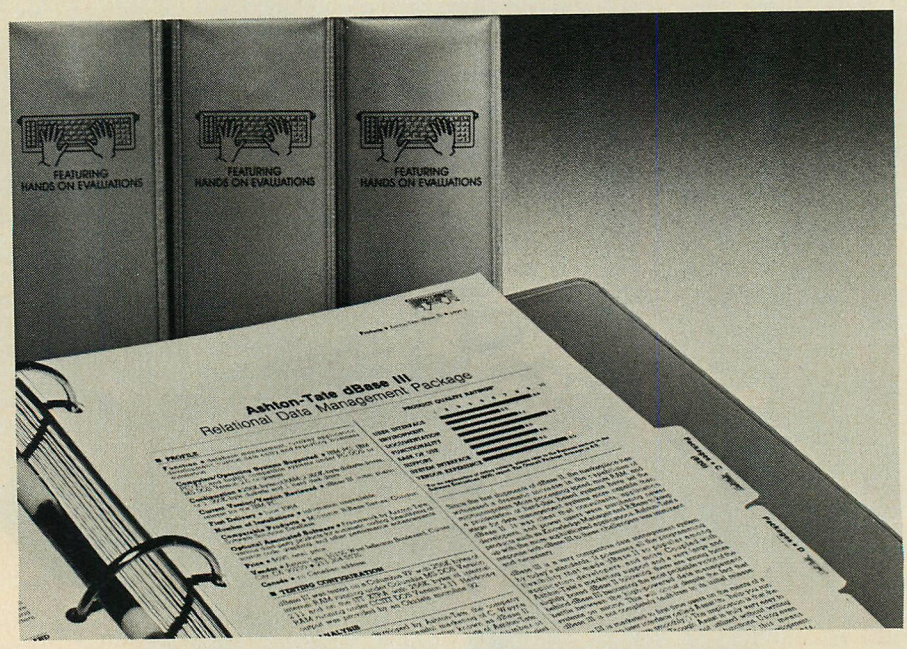
"Suddenly I'm the corporate guru on micros, but I don't have answers to the questions I'm being asked."

"I'm already spending too much time on product evaluations, and the field gets bigger every day."

—If these complaints sound familiar, this is the help you need.

INTRODUCING DATA DECISIONS MICROCOMPUTERS

An ALL-NEW information service for the corporate micro buyer that features HANDS-ON TESTING of micro software and peripherals by experts in Data Decisions' own labs.



That's right, now you can get the results of hundreds of hands-on tests done under consistent, controlled conditions by our specially trained team of micro experts—who will tell you what each product's strength and limitations are, how competing products compare, and what you can expect when you bring them in-house.

And hands-on evaluations of software and peripherals are just the beginning! Data Decisions MICROCOMPUTERS is your one-step look-up source for what you need to know about LANs... PC-compatibles... specialized workstations—for ALL your micro information needs.

MICROCOMPUTERS comes to you in 3 loose-leaf volumes which are updated every month to ensure their accuracy. They give you:

- Hands-on evaluations of key software and peripheral products.
- Rating charts that let you compare how competing packages measure up in actual use.
- In-depth analyses that highlight strengths and limitations of mainstream hardware, software and peripheral products.
- Action-oriented technology reports that fill you in on issues and trends.
- Broadbased surveys on accounting software, electronic mail packages and other important areas.
- Lively monthly newsletters that bring you late-breaking industry happenings and new product announcements, point out the best articles published in recent computer magazines, and provide a summary of the month's hands-on testing scores and a calendar of industry events.
- Unlimited free telephone consulting by micro experts whose only job is to answer your questions.

Whether you're looking for 10 micros or 100, an integrated software package, a micro-to-mainframe downloader, graphics—or the right combination of products capable of working together, MICROCOMPUTERS has the information you need.

Data Decisions MICROCOMPUTERS covers the market from A to Z.

Microcomputers: desktops, intelligent terminals, UNIX systems, execu-

tive workstations, integrated office automation workstations, supermicros, kneetops, portables, transportables... AND MORE.

Software: graphics, accounting packages, financial packages, training packages, operating systems, utilities, DBMSs, office automation, word processing, communications—PLUS the new integrated packages... AND MORE.

Expansions/Extension Cards: controllers, clocks, A to D converters, extra quad boards, interface boards, language cards, solid state disks, memory boards, processor enhancement, auxiliary processors... AND MORE.

Communications: micro LAN networks, micro modems, micro terminals, terminal emulators, micro-to-mainframe downloaders, database access packages, electronic mail... AND MORE.

Peripherals/Accessories/Support Equipment: printers, plotters, monitors, floppies, hard disks, keyboards, tape drives, OCR bar codes, sensors, power supplies, power surge protectors, cooling fans... AND MORE.

Easy-to-Use: Specially designed dot charts point you quickly to the products that meet your needs... Rating bar charts let you see at a glance how similar products compare... Easy-to-read graphics point out the differences between models from the same vendor... Consistent formatting makes it easy to compare competitive offerings and find specific facts.

Current: Up-to-the-minute newsletters and report updates reach you every month... Complete revision of all product reports are issued at least once a year.

Personalized: Each MICROCOMPUTERS subscriber is eligible for unlimited free telephone consulting with microcomputer experts whose only job is to provide quick answers to your questions.

"I looked at two other micro services but yours was far superior. Your people do a wonderful job on the hands-on evaluations. I particularly appreciate the way you look at a product from a corporate standpoint, not just from the technical point of view.

I had MICROCOMPUTERS at my last job, and when I came here, ordering a new subscription was one of the first things I did."

—Gerald Nadeau, Systems Analyst
Analog Devices, Inc. Burlington, MA

"Just one report saved me three nights of tinkering at a computer store on my own time. It's like having a consultant sitting right there at the end of the desk."

—Bob Butler, Mechanical Engineer
Gillette Company Boston, MA

have used Data Decisions MICROCOMPUTERS to help them make the right choices.

The annual subscription rate—complete with all 3 volumes, updates, newsletters and free unlimited phone consulting service—is only $800 plus $25 shipping and handling... far less than you'd have to pay an outside consultant for even one of our in-depth evaluations.

Data Decisions is so confident of your response to MICROCOMPUTERS that we are offering to let you examine all three volumes at your leisure in your own office with absolutely no purchase obligation. The only charge for this outstanding offer is the shipping and handling fee—which will be credited to your purchase if you subscribe.

Order your trial review today and see for yourself how Data Decisions MICROCOMPUTERS can save you hundreds of hours of product testing and thousands of dollars in costly purchasing mistakes.

Data Decisions MICROCOMPUTERS service is:

Comprehensive: It offers you the most complete, concise, accurate information ever compiled on micros.

Authoritative: It's put together by the largest, most experienced staff of micro experts in the publishing industry today—experts who don't just read about products, but who test them in our labs.

Analytic: Hard-hitting independent analysis highlights strengths, limitation and suitability to a corporate environment of all mainstream products.

Practical: Reliable user ratings let you see how products measure up in actual use.

Convenient: One service gives you all the information you need.

"Your telephone consultants are just outstanding—a really great group. They provide timely, personal response to virtually any type of inquiry."

—Stan Leu
Director of Marketing, DS Agency Inc.
(Agents for Exxon Office Systems)
Lubbock, TX

Economical: A 1-year subscription costs no more than you would have to pay a consultant to do just one of our hands-on evaluations.

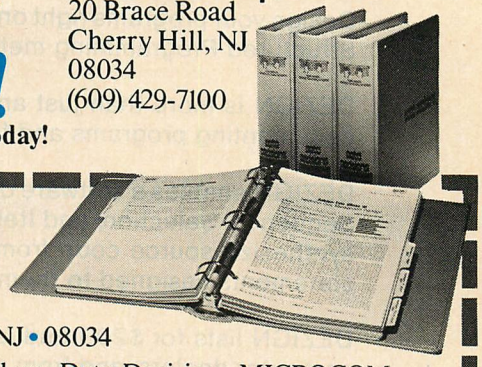
SPECIAL NO-PURCHASE-OBLIGATION TRIAL REVIEW OFFER

Thousands of smart DP professionals and micro buyers like yourself

ACT NOW!

Complete this order form and mail today!

Data Decisions
microcomputers
20 Brace Road
Cherry Hill, NJ
08034
(609) 429-7100



Data Decisions
microcomputers
20 Brace Road • Cherry Hill, NJ • 08034

☐ C5 **YES!** Please send me Data Decisions MICROCOMPUTERS for a no-purchase-obligation trial review. I understand that the only charge is a $25 shipping/handling fee which will be credited to my purchase if I subscribe.

☐ Y4 Although your offer sounds great, I'm still not convinced. Please send me additional information.

A111

Signature_____

Name_____ Title_____

Company_____

Address_____

City_____ State_____ Zip_____

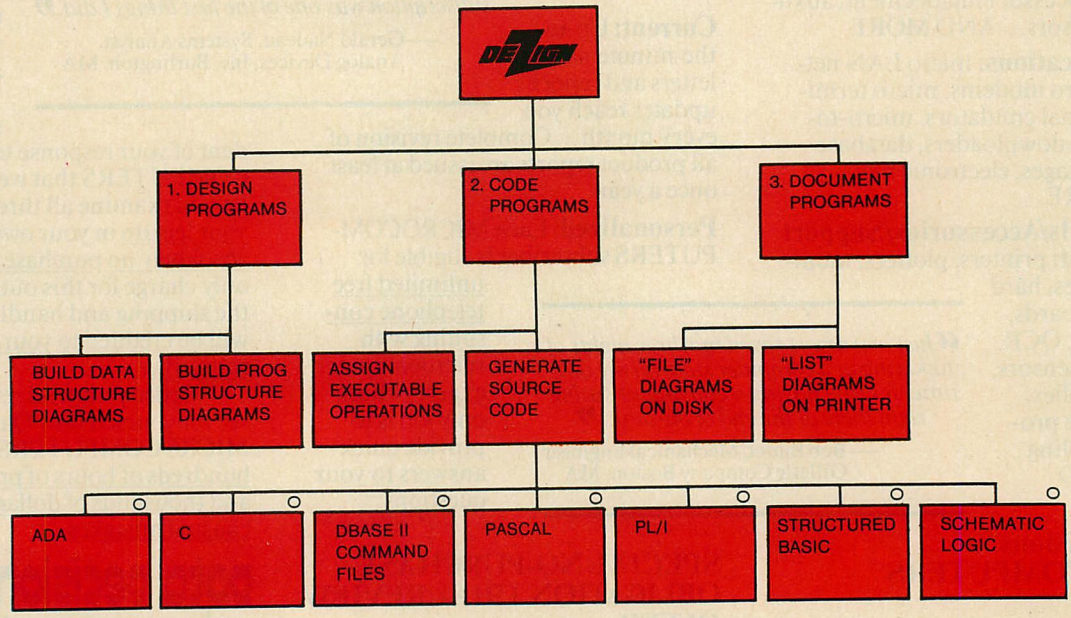
Phone ( )_____

CIRCLE NO. 126 ON READER SERVICE CARD

EVERY PROGRAMMER/ANALYST NEEDS . . .

DEZIGN

. . . THE STRUCTURED PROGRAMMING TOOL!



Design your programs right on the screen using modern techniques based on the popular Jackson Structured Programming method (JSP)!

DEZIGN is more than just another flowcharting tool. It is an integrated tool for designing and documenting programs and for generating source code in any of the languages listed above!

DEZIGN enables a software developer to create Data and Program Structure Diagrams using the Sequence, Selection, and Iteration constructs; assign detailed statements to the Diagrams; and synthesize source code from the control logic represented on the Diagrams and the detailed statements assigned to them.

DEZIGN lists for $200 and is available directly from Zeducomp, from IBM and Zenith personal computer dealers, and from software retailers.

- DEZIGN-PC runs under DOS 2.0 and 2.1.
- DEZIGN-86 runs under CP/M-86 1.1 and Concurrent CP/M-86.
- DEZIGN-16 runs under ZDOS on Zenith Z-100 computers.

"Principles of Program Design," by M. Jackson, Academic Press, describes the JSP metholology and is available for $50 directly from Zeducomp and from most professional/technical book stores.

ZEDUCOMP

P.O. BOX 68 ● STIRLING, NJ 07980 ● (201) 755-2262

dBASE II is a trademark of Ashton-Tate, Inc.

CIRCLE NO. 178 ON READER SERVICE CARD

Documentation That Works

MICHAEL A. COVINGTON

What could be more important than programming? The documentation that makes the programs possible to use.

The single most complained-about part of any microcomputer system nowadays seems to be the documentation, and with good reason: the documentation that comes with software is plagued by obscure language, impenetrable organization, and even outright errors. This is a pity, for as more people with nontechnical backgrounds turn to the computer, its usefulness is limited not by its hardware or software but by its documentation. The software crisis of the 1970s has given way to the documentation crisis of the 1980s.

Inevitably, most software is, and will continue to be, documented by the people who write it. Until some documentation is written, only the programmer really knows how to use the program; a technical writer can, at best, only transform a rough sketch into a finished product. Programming and writing are very similar skills—both rely crucially on top-down design and on keeping track of what information has and has not been introduced at a particular point—and there is no reason why good programmers cannot be good writers as well.

IT TAKES WORK

Documentation is arguably *more* important than programming. After all, the program becomes usable only through documentation. (How useful would a BASIC interpreter be if no written description of BASIC existed or if half the language's features were undocumented?) Moreover, the documentation is often the only part of a software package that the prospective user sees before making the purchase; in his eyes, a hard-to-use manual is a sure sign of a hard-to-use program. Most people would probably prefer to have mediocre software with excellent documentation than excellent software with mediocre documentation.

Software authors relegate documentation to the last minute and write their manuals sloppily and in haste. Unfortunately, haste does the same thing to documentation that it does to programs—it introduces bugs, inconsistencies, and mistakes. There is no way to produce good manuals without allowing plenty of time for checking and revision.

ADDRESS AN AUDIENCE

Never lose sight of the fact that a writer does not just record facts on paper—he is creating a piece of reading matter. A writer cannot write effectively without knowing what sort of reading matter he wants to create, and for whom.

Most crucially, the writer has to keep track of what the reader knows (both his background knowledge and what the writer has told him) and what he can be expected to understand. If you are documenting a word processor for beginners, don't talk about ROM BIOS. (In fact, if you have written a word processor for beginners, and it cannot be operated by someone who doesn't know what ROM BIOS is, you have

Michael Covington does research on artificial intelligence and the applications of supercomputers at the University of Georgia. He has a Ph.D. from Yale University in linguistics and has taught in the freshman writing program of the University of Southern California.

written a bad piece of software.) On the other hand, you can safely assume that anyone who wants to use your latest package of assembly language macros will already know how to turn the computer on.

One particular problem to watch is vocabulary. You may know that a reboot, a reset, and a Ctrl-Alt-Del are one and the same operation, but your reader will not. Pick one term, explain it early on, and stick with it. The worst sin in this category is to make up terms of your own, or give new meanings to existing terms and use them without explaining them—simply because you have forgotten that you and a few colleagues are the only people in the world who know what they mean. It is almost as bad to introduce your own information in the wrong order, so the reader is unable to understand chapter 2 until he has read chapter 5.

If you have to introduce terms that are new to the user—and you will in any manual suitable for beginners—try to do it at an even pace. If you ask the reader to gulp down a 200-word vocabulary in the first few pages, you will lose him. Instead, use concrete language that refers to objects the reader can see in front of him—for example, "Insert the program disk in drive A:, hold down the Ctrl and Alt keys, and press the Del key" rather than "Boot from the program disk." Be systematic, so that the reader gets an overall picture of how the computer works, not just a set of disconnected definitions.

In many cases you will discover that your product has two audiences: a large number of beginners and a smaller number of users who already know how to operate the computer. You should consider writing separate sections of the manual for each of these groups—for example, "Introduction for Beginners" and "Introduction for Advanced Users".

KNOW YOUR PURPOSE

At least as important as knowing your audience is knowing what you want to do for your audience. For the whole manual, the answer is usually simple: you want to tell people how to use your software. The question of purpose becomes more important as you divide the manual into sections. Each chapter should serve one specific purpose: to tell beginners how to start the program, to explain file handing, to explain use of the printer, etc. The chapters should be divided into sections, each of which has a clear sub-purpose, and so on down to individual paragraphs and even sentences. Never, *never* start writing a section or subsection of any size without first knowing exactly what you want to cover in it.

People yank out manuals and rummage desperately through them as the computer spews out pages of unintelligible printouts or their carefully constructed spreadsheet is eaten by a hungry cursor.

ORGANIZE

Remember how people use manuals—they yank them out and rummage desperately through them as the computer spews out pages of unintelligible printouts or their carefully constructed spreadsheet is devoured by a hungry cursor. If a manual is to be used under such circumstances, it has to be arranged so that the user can determine instantly where a particular piece of

BACKUP PROTECTED SOFTWARE WITH COPY II PC

COPY II PC is the backup insurance you need to protect your software investment. Voted as third most popular utility in PC World, **COPY II PC** makes a backup of virtually everything. Others may make similar claims, but in reality nothing out performs **COPY II PC**... at any price. And in most cases, **COPY II PC** even runs faster and costs less, too!

COPY II PC formats, copies, then verifies the duplicate disk. It automatically uses all the memory in your PC, and adjusts for single/dual sided diskettes.

MINIMUM REQUIREMENTS:
IBM PC, PC/XT, COMPAQ (and most compatibles)
64K Memory
PC DOS (any version)
One Disk Drive

Available at your local dealer or direct from:

ONLY
$39.95
(Plus $3 Shipping & Handling)

CENTRAL POINT Software, Inc.
9700 S.W. Capitol Hwy., #100/Portland, OR 97219
(503) 244-5782 MasterCard VISA **WELCOME**
(Prepayment Required)

Backup Utilities Also Available For:
APPLE II, MACINTOSH, and COMMODORE 64

This product is provided for the purpose of enabling you to make archival copies only.

CIRCLE NO. 112 ON READER SERVICE CARD

Up Your AT™

■ Emerald System's new 60MByte ¼" cartridge tape subsystem is the perfect answer to faster processing of your PC AT's larger, more numerous data files.

Forget about keeping track of expensive floppies. Because this internal upgraded kit has everything you need, including BRU™, Emerald's unique Backup and Restore Utility™.

BRU works as your personal librarian, helping you to retire and track files for archival storage and enabling you to safely and easily transfer files between your Emerald or IBM hard disk and floppies and Emerald's ¼" tape cartridge.

MORE RELIABLE

Our BRU-equipped tape drive protects your valuable data and helps assure timely access. All data written to tape is checked, and all write errors are corrected automatically.

Even if your AT floppy or disk drive is non-operational, you can still load files directly from tape. Media interchangeability with other machines also running BRU assures you easy access to your valuable data even if your machine is not operating. And our cartridges also allow you to distribute data files that don't fit on floppies.

MORE CONVENIENT

Do multiple volume backup from your IBM or Emerald hard disk or floppies on one data cartridge. And with a utility such as ProKey™, your backup procedure can be fully automated. BRU options invoked from the DOS command line or from a convenient menu gives you these choices:

- Backup an entire physical disk.
- Backup a logical volume.
- Backup entire DOS directories.
- Backup files by name (wild card allowed).
- Backup files by DOS date and time stamp.

■ And you can forget about file sizes. Emerald's BRU automatically breaks up files that are longer than the tape. Restoring files from tape involves options essentially the reverse of backup.

MORE ECONOMICAL

Emerald's 60 MByte tape cartridge gives you 50 times more storage capacity, yet costs less than 1/5 that of new high-capacity floppies. And for as little as $65 per MBYte you can install our hard disk kit in your PC/AT chassis. Emerald Systems' internal 40, 65, 140, 280 MByte hard disk AT upgrade kit is also 30% faster than IBM's. And our hard disk cache feature makes retrieval speed of selective files 100 times faster. This hard disk caching feature keeps often-used files available in memory at microspeed access time. And you can partition our disks into 1 to 24 volumes, with up to 240 MBytes per volume.

You may not need 280 MBytes today. But if you need to share disk storage in your LAN or expand your database without being limited by DOS to 32 MBytes, you need Emerald Systems' technology today.

SUPPORTS ALL MAJOR OPERATING SYSTEMS & LANS

Emerald's subsystems support DOS 2.0/2.1./3.0, QNX, PC/IX, UCSDp System, and XENIX (when available). Also, all fully compatible LAN's including 3 COM, PC-NET, X-NET, NOVELL, and IBM's version of SYTEK's LAN (when available).

EMERALD
SYSTEMS CORPORATION
Mainframe Storage for Micros

A COMPREHENSIVE SOLUTION —AVAILABLE NOW!

Emerald Systems Corporation. The complete hard disk and tape backup solution for builders of desktop computer systems.

So up your AT, your XT, your PC, or your PC compatible system . . . with Emerald Systems' mainframe storage for micros. **Call (619) 270-1994 for more information and the name of the dealer nearest you.**

4901 Morena Blvd.
San Diego, CA 92117
(619) 270-1994

CIRCLE NO. 145 ON READER SERVICE CARD

YOUR CODE MAY BE WASTING ITS TIME!
THE PROFILER™ CAN HELP . . .

- **Statistical Execution Profiler**
- **Works with any language**
- **Completely configurable**
- **Up to 16 partitions in RAM/ROM**
- **Time critical code optimization**
- **Abnormal code behavior tracking**
- **Graphic presentation of results**
- **Easy to use menu interface**

THE PROFILER is a software package which gives you, the programmer, a powerful tool for locating time consuming functions in your code and allows you to performance tune your program. With **THE PROFILER** you can determine where to optimize your code for maximum benefit, then measure the results of your efforts.

Using **THE PROFILER,** you can answer questions like:
Where is my program spending its time?
Why is my program so slow? What is it doing?
Is my progam I/O bound? CPU bound? Are data buffers large enough?
How much improvement did my changes make?

THE PROFILER is completely software based and consists of a system resident driver and a monitor program. The memory partitions can range from 1 byte to 1 megabyte in size and can be anywhere in the address space.

dwb Associates

P.O. Box 5777
Beaverton, OR 97006
(503)629-9645

NO ADDITIONAL HARDWARE IS REQUIRED!
Requires an IBM PC or compatible system with a minimum 64k and one drive.

THE PROFILER is available for $125.00 **(New Low Price)** from DWB Associates or ask your software dealer. To order or for more information, call or write DWB Associates. VISA/MC accepted. Dealers welcome.

IBM is a trademark of IBM Corp. MSDOS is a trademark of Microsoft Corp.
THE PROFILER is a trademark of DWB Associates.

CIRCLE NO. 216 ON READER SERVICE CARD

PC EXPANSION UNITS

HARD DISK SUBSYSTEM
- 10 OR 20 MEGABYTE CAPACITY
- DOS 2.0 COMPATIBLE
- SYSTEM INCLUDES DRIVE INSTALLED IN CABINET WITH POWER SUPPLY, INTERFACE CARD FOR INSTALLATION IN PC AND CONNECTING CABLES
  10 MB - $1995 20 MB - $2295

BUS EXPANSION MODULE
- DOUBLES THE EXPANSION BOARD CAPACITY OF THE PC
- INTERFACES TO PC THRU SIGNAL CONDITIONED CABLE ASSEMBLY WHICH OCCUPIES A SINGLE SLOT IN PC
- SYSTEM INCLUDES CABINET WITH 6 SLOT BACK PLANE AND 4 OUTPUT POWER SUPPLY, INTERFACE CARD AND CONNECTING CABLE - $645

DESERT TECHNOLOGIES

P.O. BOX 41628
TUCSON, AZ 85717 (602) 882-1741

CIRCLE NO. 118 ON READER SERVICE CARD

information is supposed to be.

It is important to distinguish between tutorial organization and reference organization. A manual designed for quick reference should have related information in the same place—all the formatting commands in one chapter and all the cursor movement keys in another. But a person first learning to use the software may not want to look at all 120 formatting commands and all 36 cursor movements the first time he reads the manual; he wants a useful, basic subset so that he can get started with a minimum of bother. Sometimes a single manual can be useful for both purposes; more often, if your software is being used by beginners, it is a good idea to write an introductory guide and a reference manual as two separate documents.

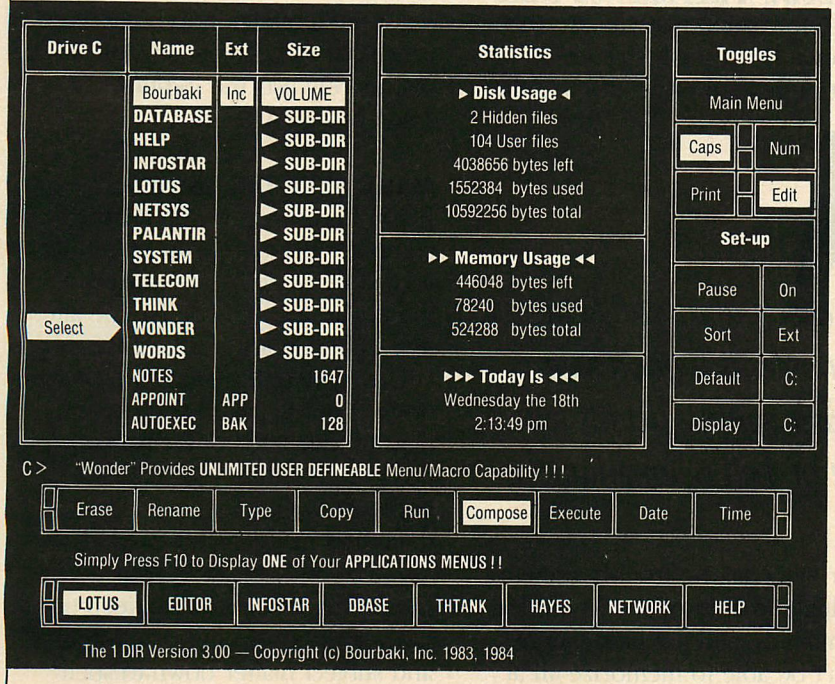
KEEP IT CLEAR

Writing students are often afraid to use clear, simple language. For some reason they think that obscure language somehow sounds more elegant—that it is better to say, "Objective consideration of Jones's situation makes it evident that his continuation would not be in the best interests of the company" than "Jones should be fired."

When you are considering firing Jones, perhaps it does sound better to conceal the painful truth behind big words. In a computer manual, however, you do not want to conceal the truth—you want to display it for everyone to see. You do not want to show off your mastery of elegant language; you want to get your ideas into the reader's head as easily as possible. In any case, if you write like a bureaucrat, you are not displaying eloquence; you are showing that you cannot get to the point, or even that you do not quite know what the point is.

Some people write obscurely because they are hemmed in by too strict a concept of English grammar.

"WONDER" 3.00 does for DOS what Lotus™ did for Spreadsheets



the 1 dir "Wonder"

EASY to USE "VISUAL SHELL" for DOS

"WONDER" integrates a powerful File Management System with extensive user definable Menu/Macro capability. Create menus and program single keystroke commands to run any or all of your applications. Create your own customized HELP system for yourself or other users.

If you are a member of the growing population of new PC users, whose interest lies primarily in taking advantage of the computer as as information management tool, this program was designed for you. If you have a hard disk, you shouldn't be without it!

Personal Computer Age — 6/84
Housebreaking the Hard Disk and DOS — by Jim Creane
"One of the unusual aspects of this product is that it is equally usable by beginning users, programmers and users that delight in intricate personalized adaptations."

"WONDER" is also a *perfect* Training Tool that grows *with* the *user!*
A real *problem solver* for MIS Managers and Systems Integrators.

Licensed by QUADRAM, QUBIE Datagraphix, Pontiac Motor Divison.

Works with the IBM PC/XT/AT family. (DOS 2.00 — 3.00), plus compatibles.

Call, write or see your local dealer for more information!
Evaluation copies available to dealers and corporate clients.

by Bourbaki Inc.™ $95.00

P.O. Box 2867, Boise, ID 83701, (208) 342-5849

Lotus is a trademark of the Lotus Development Corporation.

CIRCLE NO. 108 ON READER SERVICE CARD

They have been taught not to split infinitives (let's see now, what is an infinitive?), not to end sentences with prepositions, not to begin a sentence with *and* or *but*, not to say *I*, and so forth. These rules were not handed down on Mount Sinai; many of them were made up in the eighteenth and nineteenth centuries by schoolmasters who wanted to make the grammar of English as much like that of Latin as possible. When your main concern is getting your point across, do not worry too much about these strict rules of grammer. If you have grammar problems, get an English major to read through your documentation *at the very last stage*, just before it goes to the typesetter. In the meantime, don't worry about it. If you express yourself naturally, you will always be clear and almost always be grammatical; if you get bogged down thinking about grammar when you ought to be thinking about your point, your writing will probably end up being neither grammatical nor clear.

USE EXAMPLES

All along, the reader will be wondering whether he has understood you correctly, and the only way he can find out is by looking at an example and seeing whether it works the way he expects. An abundance of examples is also a good safeguard against details left out of the documentation, and some readers will even learn the system from the examples rather than the text.

INCLUDE A REFERENCE CARD

The information that you are trying to get across usually divides up into a set of general principles that the user will have no trouble remembering and a set of details (codes, commands, and the like) that he won't be able to memorize all at once. The reference card should contain only the details. A good format to follow is to give the name of each command or code, its format and function, an example, and a page number in the manual where more information can be found. Page references to the manual are especially handy when they appear in help files or error messages displayed by the program.

An abundance of examples is a good safeguard against details left out of the documentation.

Naturally, the manual should include an index—one that actually helps the reader find what he is looking for. See *The Chicago Manual of Style* for advice on indexing; resist the temptation to use a word processor to generate an "index" that merely lists the locations of some common words.

MAKE SEVERAL PASSES

If you have ever written a large computer program, you know that it can't be done by just starting at the beginning and coding line after line until you are finished. Instead, you start by outlining the major sections of the program and deciding exactly what each of them is supposed to do; then you write the sections one by one; finally, test them and make improvements.

Writing English prose is the same way. If you tried to keep track of everything—from organization and subject matter down to spelling—all at once, you would become hopelessly confused. Instead, work through what you are writing several times, dealing with only one issue at a time. The following is a good order in which to proceed.

Organization. Decide the purpose of the complete document, how to divide it into sections, and what each

ONE KEY IS WORTH A 1000 LINES

TALL SCREEN™ extends your screen at the touch of a key

PAGE BACK
RECALL
EDIT
FREEZE

PAGE BACK and **EDIT** up to 1000 lines of previous output. **RECALL** previous DOS commands or previous paths with a single keystroke. **EDIT** text anywhere on the screen. **FILE**, **PRINT**, or **FREEZE** windows on the screen.

Run programs unattended, review output at your convenience. Create customized keystroke profiles as in the IBM Personal Editor.

TALL SCREEN is a powerful tool for the PC user who values time and control.

$49.95 INTRODUCTORY PRICE

For orders or information see your local dealer or call **1-800-522-0290**

For the IBM PC®, PC Jr, XT, AT, or compatibles. Compatible with PCDOS 2.00, 2.10, 3.00 and 3.10. Compatible with most mouse systems and joysticks. Works with PROKEY™ and SIDEKICK™. Next day shipping on VISA/MC orders. Price includes all domestic shipping and handling. No extra charge for VISA/MC. MD & NM residents add sales tax.

QUALITAS™
QUALITY PROGRAMMING TOOLS

QUALITAS, INC., P.O. BOX 3AK UPB, LAS CRUCES, NM 88003 505-522-0290

CIRCLE NO. 162 ON READER SERVICE CARD

Discover Solutions With Vision

Dealers are finding Pacific Datanet's Vision™ hard disk sub-systems are today's personal computer users' choice for mass storage sub-systems.

The Vision Series is more than illusionary—read on!

Capacity *A variety of sub-systems—12/10Mb, 19/17Mb, 26/21Mb, 40/32Mb, 50/43Mb, 70/62Mb, 105/92Mb, and 140/125Mb.*

Software *Menu-driven software makes installation simple with the IBM PC, XT, or IBM compatible.*

Complete Sub-System *Vision Series are complete. Sub-systems include a 5¼" Winchester, our controller, host adapter, heavy duty international power supply, software and cables.*

Fast Tape Backup *5¼", ¼" tape streamer backs up at a consistent 5Mb per minute, using standard 90 ips, ¼" tapes.*

Error Correction *Sub-systems provide 8 bit error correction.*

Reliability *Stringent quality control assures reliable operation.*

Price *Prices start at $2,195 for the hard disk sub-system, and $1,995 for the streaming tape backup.*

Dealer Inquiries Invited

PACIFIC DATANET, LTD.
4701 Patrick Henry Drive, Bldg. 9
Santa Clara, CA 95054
(408) 980-0693 Telex: 759341

**VISION is a trademark of Pacific Datanet, Ltd.*
**IBM is a trademark of International Business Machines Corp.*

Pacific Datanet

CIRCLE NO. 169 ON READER SERVICE CARD

section should accomplish. (There is nothing magical about the rigid Roman-numbered outline format that they taught you in high school; a simple numbered list of points, with room for sub-points under each of them, works just as well.)

Content. This is the step in which you actually get the information on paper—often working in an order other than that in which the material will appear. For instance, you may want to write the introductory chapter last, after you have pinned down exactly what it will lead into. If you do not yet have all the information needed for one section, you can shelve it temporarily and work on some of the others.

Style. Now that you have everything on paper, go back and improve the way it is expressed. Remove unneeded words. Simplify sentences that came out too complex or that did not come out saying exactly what you meant. Make sure you have defined terms as they were introduced. Make small changes in the organization as you see fit.

Spelling and punctuation. The hunt for spelling, punctuation, and usage errors should be done in the very last step. If you are preoccupied with spelling and grammar from the very beginning, your attention may be diverted from what you are trying to say, and writing may become needlessly difficult. Try marking items you are unsure of at earlier stages (such as words that may be misspelled) so you are able to deal with them at this last stage.

Nothing facilitates this kind of multi-pass writing so much as a word processor. You can start by putting in the bare outline, then fill in complete sections one by one, in any order. You are free to make changes at any time without facing a time-consuming retyping task, and you can print out neat copies of incomplete drafts to show to other people and get comments.

DOUBLE CHECK

Like programs, pieces of documentation need to undergo test runs. Give the program and the documentation to a brand-new user, preferably one who knows as little about the system as possible, and encourage him to tell you about any difficulties he encounters. In fact, demand that he tell you if there is any step at which he cannot follow the instructions as you have given them. At this stage you will mainly catch errors of fact and pieces of information that are presented in the wrong order; there is practically no other way to discover problems of this sort. After all, you would not release an untested program; don't release untested documentation either.

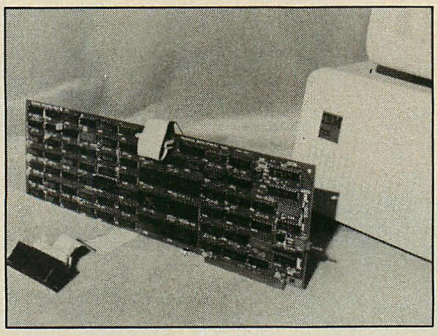
DEVELOP BETTER SOFTWARE FASTER

WITH **Answer Software's**

PROGRAM DEVELOPMENT TOOL (PDT-PC)

Second Edition

for IBM-PC* and Compatibles



PDT-PC TRANSFORMS YOUR IBM-PC/XT INTO THE MOST POWERFUL DEBUGGING AND ANALYSIS TOOL AVAILABLE FOR THE PC ENVIRONMENT:

- SYMBOLIC DEBUGGING AND ANALYSIS
  - LOCAL AND GLOBAL SYMBOLS
  - HIGH-LEVEL LANGUAGE LINE NUMBERS
  - FULL SYMBOLIC SUPPORT FOR OVERLAYS AND CODE MODULES
- SUPPORTS BOTH INTEL AND PC-DOS OBJECT MODULE FORMATS
- MULTIPLEXED SCREEN BUFFER PRESERVES APPLICATION DISPLAY
- SCREEN ORIENTED HUMAN INTERFACE
- FEATURING MACROS AND ON-LINE ASSEMBLER
- REAL TIME SOFTWARE PERFORMANCE ANALYSIS
- STANDARD IN-CIRCUIT EMULATOR FEATURES

ONLY THE PDT-PC INTEGRATES A FULL-FEATURED DEBUGGER WITH AN 8088 EMULATOR AND PERFORMANCE ANALYSIS, PROVIDING A SINGLE ANSWER TO YOUR MOST DIFFICULT SOFTWARE DEVELOPMENT PROBLEMS!!!

Answer Software Corporation

20863 Stevens Creek Blvd., B2-C, Cupertino, CA 95014
(408) 253-7515

*IBM-PC is a registered trademark of International Business Machines Corporation

CIRCLE NO. 206 ON READER SERVICE CARD

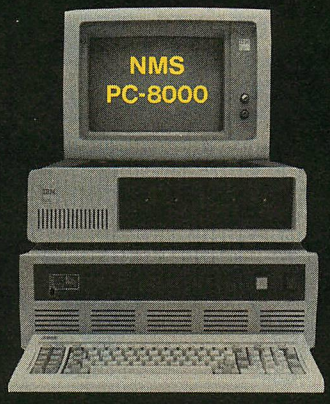
AS MUCH AS YOU NEED...

1,000 megabytes

$24,900

335mb
$13,500

480mb*
$14,900



85mb
$7,900

170mb
$9,900

25mb

42mb

FREE 67 mb, ¼" tape system with every disk system purchased before 1/31/85!**

...NMS PROVIDES

You will find only one company that offers reliability, proven technology, up to one gigabyte capacities and immediate availability – National Memory Systems Corporation.

NETWORKING APPLICATIONS AND DISTRIBUTED PROCESSING.
For large data base and accounting applications or as a file server on a local area network, the PC-8000 is ideal. In a 50-station network, a single file server could supply almost 20 megabytes of dedicated storage to each PC at a very low cost...four times faster than an XT.

FOR-IBM PC-AT
-IBM PC
-PC COMPATIBLES
-TI PC
-IBM 370 VM

*available only in rack mount configurations

SOPHISTICATED PERFORMANCE.
The PC-8000 utilizes a single board controller. Unsurpassed performance of 17 millisecond average access times and data transfer rates of more than 2 megabytes per second can now be yours. The PC-8000 Series supports overlapped seeks, 32-bit ECC with 11-bit error correction, high speed DMA and more.

EASY UPGRADES.
One single slot controller supports up to two disk drives with capacities ranging from 25 megabytes all the way up to 1,000 megabytes.

TAPE BACK-UP.
Add our 9-track, ANSI-compatible tape back-up and you've got the best performing subsystem being delivered today. Or talk to us about our high capacity 1/4-inch model.

HIGH RELIABILITY.
Failure is unlikely with MTBF figures in excess of 30,000 hours. Backed with our standard 12-month warranty and nationwide maintenance service your investment is protected.

LASER OPTICAL DISK.
For your archival needs, our PC-007 Series provides 1,000 megabytes of non-erasable storage at a fraction of the cost of tape back-up.

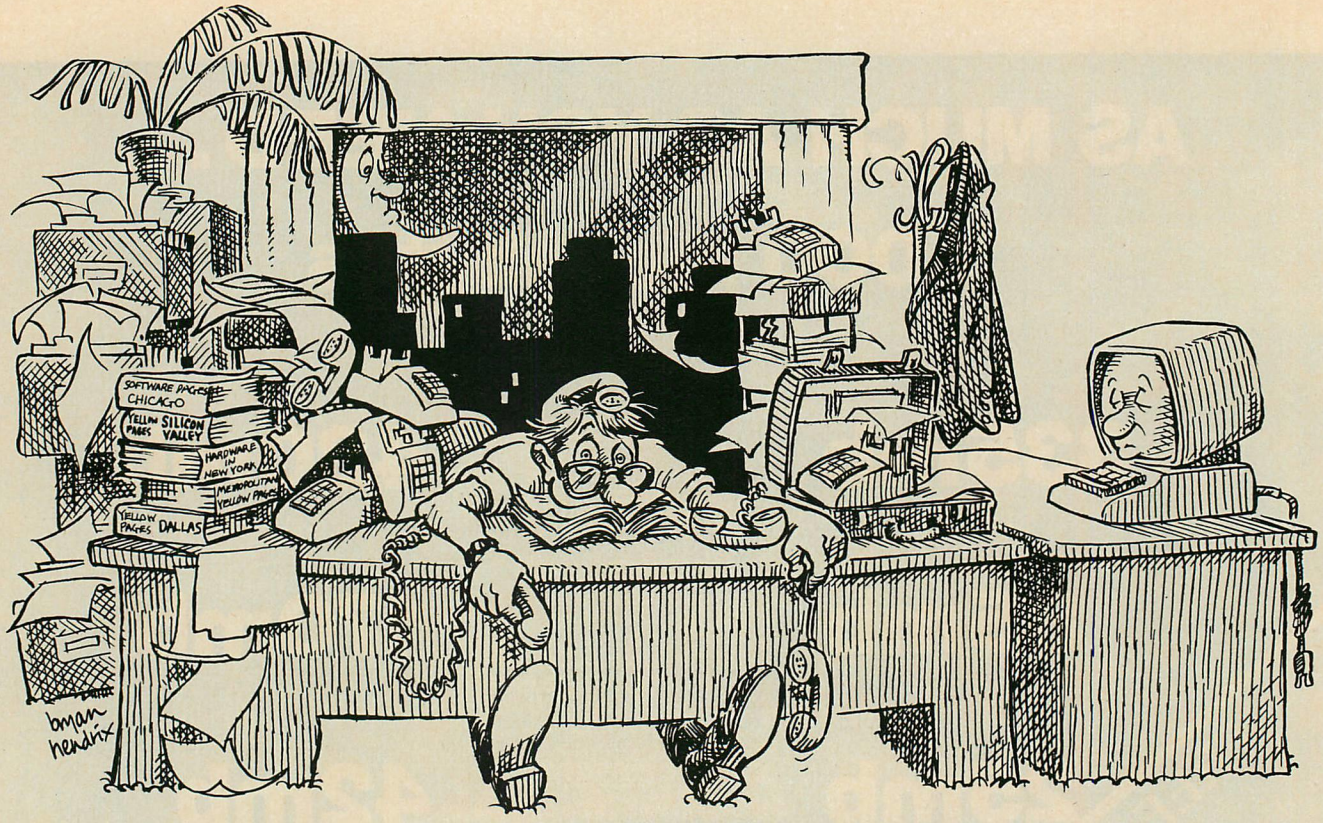
CALL US.
If you're looking to buy or lease high capacity disk storage for your PC, and you want delivery NOW, call National Memory Systems at **(415) 443-1669**

National Memory Systems CORPORATION

**355 Earhart Way,
Livermore, CA 94550
TWX 9103866006
TELEX 821892NMSUD**

**limited offer, maximum 49 units per customer

CIRCLE NO. 233 ON READER SERVICE CARD



Spending more time searching for the technology...than using it?

DATA SOURCES systematically organizes all your DP options!

No other resource puts over 20,000 systems and applications software packages...over 17,000 hardware and data communications products...and some 9,000 company profiles instantly at your fingertips.

DATA SOURCES is conveniently indexed to help you locate the products you seek quickly...find others you may not be aware of...and determine their capability and compatibility at a glance. You'll use...

...The Product Index, with its complete listing of every product covered by DATA SOURCES, to lead you to the larger listing quickly.

...The Company Profile Index, to help you identify all the product areas in which a firm is currently involved easily.

...The Company/Product Index, to find each vendor's full range of products within each equipment category instantly.

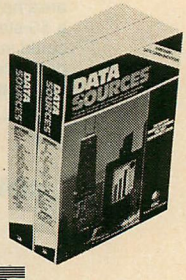
...The Software Index, to help you access specific packages, even if you're not sure of the author or product classification.

And DATA SOURCES' handy comparison charts let you review similar products by multiple manufacturers for key criteria, including compatibility and price.

PLUS...in-between quarterly editions, subscribers have access to the exclusive DATA SOURCES HOTLINE for information on product location assistance.

JUST CALL (800) 227-1617 ext 251 TODAY! (In California, call (800) 722-3543 ext. 251)

We'll send your first 2-volume edition on a 30-DAY APPROVAL basis and enter your year's subscription to DATA SOURCES at just $150...$60 off the regular cover price...FOR 4 quarterly editions.



DATA SOURCES T325

Leading the Industry in Information Management

P.O. Box 5845, Cherry Hill, N.J. 08034

CIRCLE NO. 202 ON READER SERVICE CARD

WRITING IMPROVED WHILE YOU WATCH

Here is an example of a sentence that needs improvement. I wrote it while working on a draft of this article.

One of the best things you can do for yourself to improve your writing is to learn to cut out words that are unnecessary.

Let's start by changing *words that are unnecessary* to *unnecessary words*. And the *for yourself* toward the beginning of the sentence can go, since if you are improving your writing, you are obviously doing something for yourself.

One of the best things you can do to improve your writing is to learn to cut out unnecessary words.

Now then. What else can go? Obviously not *cut out unnecessary words*—that's the main point of the sentence. Let's see if we can hack off anything else toward the beginning. How about *things you can do*?

One of the best ways to improve your writing is to learn to cut out unnecessary words.

Not bad—but is there really any difference between *learning* to cut out unnecessary words, and just doing it? In some contexts the distinction might be important, but it is not in this particular case.

One of the best ways to improve your writing is to cut out unnecessary words.

This leaves 15 words where originally there were 24 and cuts 40 percent off the cost of typing and printing the sentence. Because reading difficulty depends on complexity as well as length, the sentence has become more than 40 percent easier to read.

All writing needs this treatment. Cut out words such as *basically*, *essentially*, and *very*, and phrases such as *It is obvious that*. They convey no information to the reader. Look for abstract nouns, especially words that end in *-tion*. They often indicate you have chosen a more complex sentence structure than necessary. Rework passive sentences, because fewer words are needed to say *X does Y* than *Y is done by X*, and it saves the reader some effort. Above all, eliminate repetition. If several consecutive sentences make the same point, delete all but one of them. —*MC*

DEALING WITH PRINTERS AND TYPESETTERS

If you market a piece of software yourself, it is up to you to arrange production of the documentation that goes with it, and this usually means employing a local typesetter and printshop. The most vital point to recognize is that the cost of printing depends not on the number of copies produced, but on the amount of preparation, platemaking, and set-up work required. Once the printer has his press set up, he doesn't much care whether he runs it for 2 seconds or 2 minutes—which is why 25 copies will cost almost as much as 500.

In practical terms this means that the elaborateness of printing that you can afford depends on how many copies you can spread the cost over. If you are producing fewer than 50 copies, consider avoiding the printshop altogether and distributing your documentation either as a computer printout or as a high-quality Xerox of a neatly typed original. In the 50-to-500-copy range, use photo-offset—the least expensive kind of printing, in which the printer photographs your typed pages and reproduces them exactly. With a word processor and a good letter-quality printer, you can get fine results using this method.

If you are producing more than 500 copies, you can probably afford to have your copy typeset. You must be prepared to proofread it yourself, however. Typesetters make mistakes, especially on technical material, and typographical errors in computer manuals can be disastrous. Typesetting shops that can accept your copy on disk or by modem are a godsend.

More seriously, a typesetter accustomed to putting addresses at the tops of letterheads may not know how to design a book, and your masterpiece may come out with margins too small, spacing and indentation wrong, or page numbers omitted. What you may need is a graphic artist to design a layout and then specify the type accordingly. If you plan to rely on the printer or typesetter for this service, be sure to look at samples of the printer's work, and inquire whether the layout and typesetting were done in-house. Better yet, choose your printer by finding out who printed a recent manual or corporate report that you like the looks of. —*MC*

C

SOFTWARE DEVELOPERS!

V - FILE
THE VIRTUAL MEMORY FILE MANAGER

Let V-FILE save precious development time & cost as you create efficient applications with the power of VIRTUAL MEMORY.

DON'T RE-INVENT THE WHEEL

Why spend weeks or months coding and debugging file and memory management systems when you can order V-FILE today. V-FILE is a library that you can link with your code to provide sophisticated virtual file and memory management — allowing you to concentrate on developing your application.

VIRTUAL DATA OBJECTS SUPPORTED!

Data is referenced by using VIRTUAL MEMORY DATA HANDLES. Your code doesn't need to know whether the data is actually on disk or in RAM. Swapping between disk and RAM and updating files on disk is handled automatically and transparently! Complex VIRTUAL DATA STRUCTURES can be created by linking with data handles instead of pointers.

CHECK THESE FEATURES!

- Multiple, independent swap buffers
- Multiple files per swap buffer
- Highly efficient swap algorithm
- Automatic file updating
- Data prefetching supported
- Data may be locked in memory
- Memory buffers may be flushed
- Makes full use of extended memory on IBM PC/AT
- SOURCE CODE AVAILABLE
- NO ROYALTIES REQUIRED

Supports Dos 2.00+ with Lattice & Microsoft C compilers
Supports Microsoft windows

$299

V•FILE TM

Contact:
MindBank, Inc.
4620 Henry Street
Pittsburgh, PA 15213
412/683-9800

VISA/MASTER CARD ACCEPTED

CIRCLE NO. 154 ON READER SERVICE CARD

AHEAD OF ITS TIME

SAVE UP TO 50% ON THE FUTURE OF MICROCOMPUTING...

CREATIVE COMPUTING has been ahead of its time, trailblazing new applications and evaluating the newest releases in hardware, software and peripherals for microcomputers. We're the #1 computer magazine, not because we're 10 years old, but because we've kept our fingers on the pulse of microcomputing and our eyes on the future!

• CREATIVE COMPUTING predicted the development and use of portable computers when mainframes and punchcards were the only industry standards!

• CREATIVE COMPUTING predicted the use of microcomputers in the classroom before the first system was ever sold!

• CREATIVE COMPUTING has covered the controversies surrounding data security, personal privacy, computer abuse and ergonomics before privacy laws and keyboard design became realities!

AND CREATIVE COMPUTING WILL NOT REST ON ITS LAURELS! In future issues we will bring you to the forefront of the latest controversies, product releases and predictions that are shaping the microcomputing industry.

• Will organic chips replace silicon chips in your system?

• How will the technology of Japan change microcomputing?

• How will the Fifth Generation, the most advanced Artificial Intelligence Project, affect you?

Make computing an exciting and vibrant science with the applications, predictions and evaluations the computer world has turned to for over ten years—CREATIVE COMPUTING!

KEEP YOUR FINGER ON THE PULSE OF TOMORROW...SUBSCRIBE TO CREATIVE COMPUTING TODAY!

Creative Computing

P.O. Box 5214
Boulder, Co. 80322 PT8Z102

YES! I want to stay ahead of the times! Please accept my subscription to CREATIVE COMPUTING for:

☐ 9 issues for $9.97. SAVE 47%!
☐ 12 issues for $12.97. SAVE 48%!
☐ 24 issues for $24.97. SAVE 50%!

Savings based on full one-year (12 issues) subscription price of $24.97.

Check one: ☐ Payment enclosed ☐ Bill me later

Charge my: ☐ American Express ☐ Visa ☐ MasterCard

Card No._____ Exp. Date_____

Mr./Mrs./Ms._____
please print full name

Company_____

Address_____

City_____ State_____ Zip_____

Add 40¢ per issue in Canada, 80¢ per issue in all other countries.
Please allow 30 to 60 days for delivery of first issue.

Audio Debugging

With an FM radio you can eavesdrop on errant programs hiding in RAM.

TECH NOTEBOOK 29

JEFF DUNTEMANN

It happens regularly: you execute the latest version of your latest masterpiece, and . . . nothing. *What's that program doing in there?* Locked up in a loop somewhere, you guess—somewhere inside 1,400 lines of Pascal. Before reaching for a debugger, you wish you could see your program chasing its tail in RAM. One glance can give you all the clues you need.

Well, you can't look. But you can *listen*.

The IBM PC is an electronic switch switching in the megahertz frequency range. It can't help but produce radio waves, FCC certification notwithstanding. (My PC is by far the "noisiest" of all of my four computers.) Perch a radio atop your system unit, and you can hear an audible signature of all machine activity—including an errant program.

Any FM radio will do. AM won't work. The *amplitude* (or voltage level) of the pulses rattling around the PC's sundry parts varies little or not at all. Their *frequency*, however, varies enormously, depending on what the machine happens to be doing; frequency variations are what an FM radio detects.

Where to set the radio dial depends on the individual characteristics of a particular radio. Tune the dial for the strongest signal; my radio works best at about 99.5 megahertz. Once you find the PC's signal, just listen for awhile.

Every task the computer performs has its own "song." Disk activity can be recognized as a series of short "phht!" pulses. The PC-DOS prompt (on my radio at least) sounds like small bells ringing. Keyboard polling loops in word processors give constant tones with the ever-present 18.2-Hz rattle of the 8253 timer interrupt in the background. If you want to hear a real concert, listen to Lotus 1-2-3 or VisiCalc recalculate a complicated spreadsheet.

The best way to use audio debugging is to listen to programs as they develop. Each time you produce a working iteration of a program, turn the radio on and listen closely to a couple of run-throughs. In time you will be able to recognize the distinctive sounds of individual procedures and program loops. This way, when something goes wrong, you will hear a different sound and have a better chance of finding where the program is hanging up.

The first time I resorted to audio debugging was in response to an intermittent 8087 chip. Every so often the 8087 simply stopped dead in its tracks, forcing a reboot. The audio signature of the comatose 8087 was unique. Instead of being rhythmic, or in any way regular, the sound was simply chaotic, as if the PC were firing its bus lines at random. Someone at Intel told me that this was probably the case.

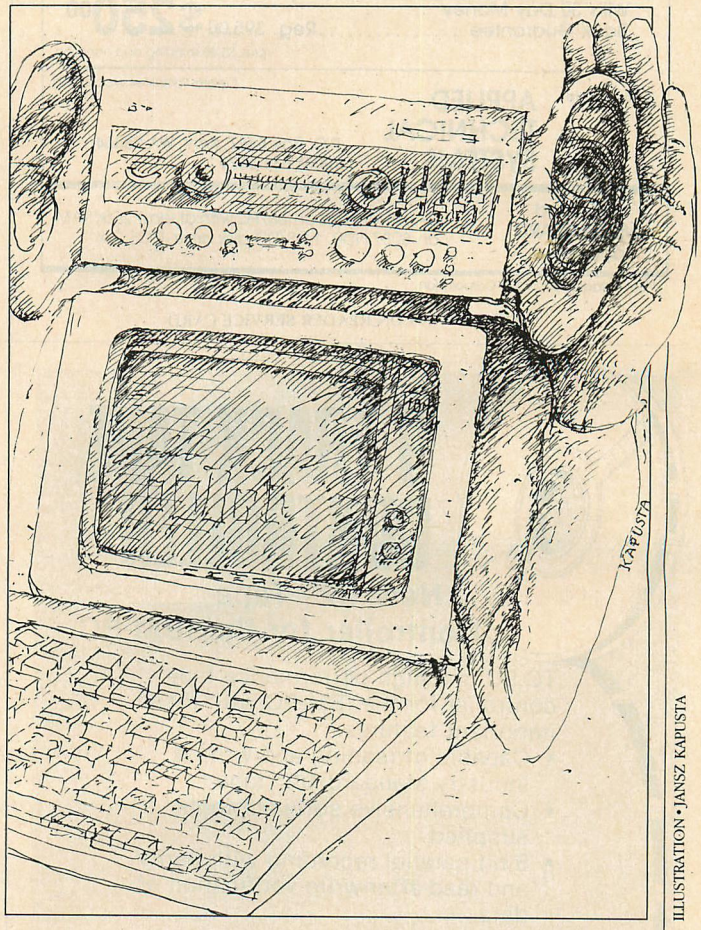


ILLUSTRATION • JANSZ KAPUSTA

Audio debugging may not be for everyone. Composed entirely of square waves, the PC's audio signature has a high-frequency edge to it that many people find supremely irritating. There are those of us, however, who enjoy being able to eavesdrop on a creature that has previously enjoyed the privilege of goofing off within the privacy of RAM, away from prying eyes and ears.

Jeff Duntemann, a programmer for Xerox Corporation, has also been an amateur radio operator for several years.

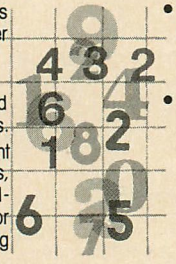
FAST • EASY TO USE • POWERFUL

GAUSS™

MATRIX PROGRAMMING LANGUAGE

GAUSS is a sophisticated matrix programming package that lets you do large scale number crunching on an IBM-PC.*

- **EXTREMELY FAST.** Uses the 8087. Is 10-15 x faster than IBM APL.
- **STATE-OF-THE-ART** numerical routines and random number generators.
- **FULL-FEATURED.** Excellent for statistics, for simulations, for solving non-linear simultaneous equations, and for anything else requiring number crunching.



- **EASY TO LEARN.** Lets you write routines almost exactly as you would write them mathematically.
- **POWERFUL.** Write complex numerical routines in a fraction of the time and with a fraction of the code they would take in Fortran, Basic, or even APL.

PUTS MINICOMPUTER POWER ON YOUR DESKTOP

SPECIAL INTRODUCTORY OFFER

With 30 Day Money Back Guarantee .....Reg. 395.00 **$250.00**

plus $5.00 shipping and handling.

Dealer inquiries welcomed

Call or Write **APPLIED TECHNICAL SYSTEMS**

P.O. Box 6487, Kent, WA 98064
(206) 631-6679

VISA and MASTERCARD accepted.

GAUSS requires an IBM PC with at least 256K RAM, an 8087 NDP, 1 DS/DD disk drive, DOS 2. x

* IBM is trademark of IBM Corporation.

CIRCLE NO. 104 ON READER SERVICE CARD

C
UTILITY LIBRARY

The **C UTILITY LIBRARY** is a set of **200+** functions designed specifically for the PC software developer. Use of the Library will speed up your development efforts and improve the quality of your work.

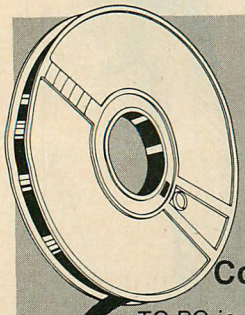
- **BEST SCREEN HANDLING AVAILABLE**
- **WINDOW MANAGEMENT, COLOR GRAPHICS**
- **DOS 2 DIRECTORIES, COMMUNICATIONS**
- **KEYBOARD, PRINTER, TIME/DATE**
- **EXECUTE PROGRAMS, BATCH FILES**
- **STRINGS, BIOS, AND MUCH MORE**
- **ALL SOURCE INCLUDED—NO ROYALTIES**

Available for Microsoft/Lattice $149, Computer Innovations $149, Mark Williams $149, DeSmet $99. Add $3 shipping. N.J. residents add 6% sales tax. Visa, MC, checks—10 days to clear.

Order direct or through your dealer. Dealer/Distributor inquiries welcome.

ESSENTIAL SOFTWARE, INC.
(914) 762-6605
P.O. Box 1003
Maplewood, N.J. 07040

CIRCLE NO. 147 ON READER SERVICE CARD



9 TRACK TAPE CONTROLLER

New 1/2" Tape Controller for the IBM-PC

TC-PC is a high performance tape controller for the IBM-PC with these important features:

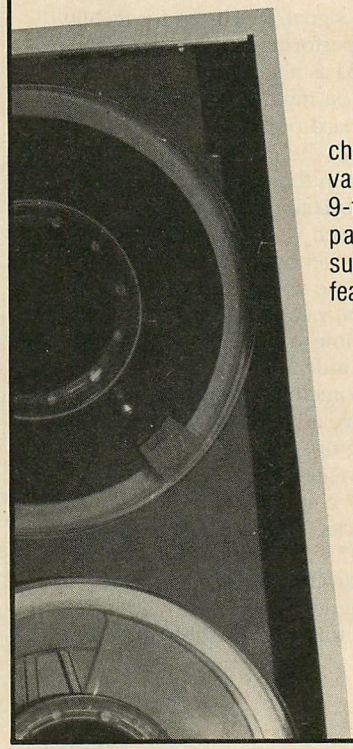
- Capable of reading and writing industry standard 1/2" tape
- Comprehensive software tools supplied
- 8 bit parallel recording with parity and read-after-write verification of data
- Compatible with most nine track formatted tape drives
- Operates with tape drive speeds up to 120 inches per second; allows data transfer rates of up to 192,000 bytes per second
- Economically priced at $880

For more information on the TC-PC, call or write today.
Dealer/Distributor inquiries invited.

OVERLAND DATA, INC.
5644 Kearny Mesa Rd., Suite A
San Diego, CA 92111
Tel. (619) 571-5555

CIRCLE NO. 185 ON READER SERVICE CARD

9-TRACK MAG. TAPE SUBSYSTEM for the IBM PC



For information interchange, backup and archival storage, IBEX offers a 9-track, IBM format-compatible ½" magnetic tape subsystem for the IBM PC, featuring:

- **42 M-Bytes on a single reel.**
- **Automatic loading.**
- **IBM format 1600 cpi.**
- **Software for PC-DOS, MS-DOS or CPM-86.**

Write, phone or TWX for information

IBEX

IBEX COMPUTER CORP.
20741 Marilla Street,
Chatsworth, CA 91311
(818) 709-8100
TWX 910-493-2071

CIRCLE NO. 124 ON READER SERVICE CARD

Protecting the Corporate Flank

Trust in an employee may be facilitated by a covenant not to compete.

Dilemma: Mom & Pop Hi-Tech, Inc. has been megasuccessful. It has produced three consecutive years of 100-percent-plus earnings growth. Venture capitalists have surrounded its offices; the neighborhood resembles the civic center the day before the Michael Jackson tickets go on sale. The company has a good product, adequate financing, a devoted and energetic work force. It also has a one-person management team. The president of Mom & Pop Hi-Tech, Inc. is stretched to the limit. He must either let the company's growth level off or get help from the outside.

Fortune has smiled: the president has found a talented, honest, loyal person whom he believes would be an ideal vice-president. The president is anxious to begin to turn over the company's secrets of success, to introduce him to its suppliers and its customers, to promote him as a superstar.

Unfortunately, the computer industry is filled with companies founded by former employees of other computer companies. What steps can the president take in order to reduce the risk that he will be grooming a competitor?

Let us assume that the new vice-president is honest, and that he will both sign and honor agreements not to use Mom & Pop Hi-Tech, Inc.'s trade secrets and not to engage in any venture inconsistent with devoting his full time, attention, and loyalty to his employer.

That still leaves a very difficult problem: suppose that the new vice-president proves to be as good as the president thinks he will be. Suppose that after another two years of record performance a competitor makes the vice-president a better offer. Or suppose that one of the venture capitalists that Mom & Pop Hi-Tech, Inc. has spurned decides that a similar company can be built around the vice-president. Even if the vice-president resigns as soon as he decides to leave, and even if he takes no trade secrets with him, it is still not a comforting thought that he will also be taking with him all of the education, all of the introductions, and all of the promoting that Mom & Pop Hi-Tech, Inc. invested in him in order to make him a fully functioning member of its management team.

Unfortunately, the computer industry is filled with companies founded by former employees of other computer companies.

What are the options? The president can continue the status quo, in which case his company will stop growing. He can hire the vice-president but not give him full access to the company's resources (or he can give him limited access at first and greater access later)—either will reduce the company's growth potential. He can give the new vice-president the keys to the kingdom and hope that the vice-president does not decide that he would rather have his own kingdom.

What would be best for Mom & Pop Hi-Tech, Inc. would be an option that would give the vice-president the best chance to help the company reach its full potential, yet prevent him from capitalizing on what he will gain by his association with the company except for the benefit of Mom & Pop Hi-Tech, Inc. Of course there is something to be said for the value of such restrictions to the employee as well—the company is more likely to give him prompt and full support if it does not have to temper its enthusiasm for fear that he may become a significant competitive factor.

The most direct approach (an agreement stating that the vice-president will work for Mom & Pop Hi-Tech, Inc. forever) is precluded by common sense and the Thirteenth Amendment. Likewise, an agreement that the vice-president never work for a competitor would probably be unnecessary (the industry is

Max Stul Oppenheimer, PC, is a partner in the law firm of Venable, Baetjer & Howard, located in Baltimore.

GET FAST RELIEF FROM IRS HEADACHES!

With TAX COMMAND Income Tax Preparatory Software Series!

On disk for IBM-PC, XT, AT, Jr., with 128K memory or more, and other compatible hardware: TAX COMMAND PROFESSIONAL: high-speed tax computation, with a wide variety of schedules, at your finger tips.

• Fast line-by-line Federal Tax information entry. • All mathematical calculations done automatically. • Built-in tax tables. • Prints on the official U.S. Tax forms. • Forget something? Tax Command Professional is flexible enough to quickly recalculate. • Cost of program is tax deductible.

This menu driven program covers the 1040 Form, Schedule A, B, C, D, E, G, R, RP, SE, W, and Forms 2106, 2119, 2441, and 3903.

$99.95.

On disk for IBM-PC, XT, AT, Jr., with 128K memory or more and other compatible hardware:

NEW! TAX COMMAND PLANNER for quick, easy planning of tax strategies.

• Specifically designed for your tax planning. • Decide how to depreciate assets. • Whether to sell stock. • How to make contributions at the lowest cost. • Six different options for five years.

$99.95.

Registered owners receive next year's up date at a reduced cost.

Double Discount! Buy **Tax Command Professional** and **Tax Command Planner** for one low price of **$179.99.**

Practical Programs Inc. stands behind its products, and will replace any defective disk.

Send me fast relief! Enclosed is my check or money order for the amount specified below plus $2.00 for shipping and handling. Please send me:

☐ **Tax Command Professional** ($99.95)

☐ **Tax Command Planner** ($99.95)

☐ **Double Discount!** Send both programs. ($179.99)

Credit card customers call (414) 278-0829.

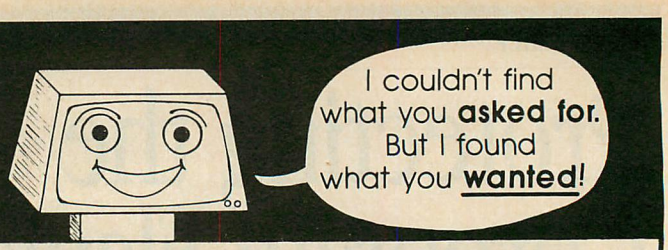
Name _____ Address _____

City _____ State _____ Zip _____

Mail to:
Practical Programs, Inc. • P.O. Box 93104
625 North Milwaukee Street • Milwaukee, Wisconsin 53203

Practical Programs, Inc.

CIRCLE NO. 155 ON READER SERVICE CARD



BEYOND TODAY'S FILING PROGRAMS?

NO LONGER!

SEEKEASY is a new type of filing program. It accepts vague, misspelled or incomplete requests, yet **still** finds your filed information. Type approximately what you want — SEEKEASY does the rest!

ISN'T THIS WHAT YOU'VE ALWAYS WANTED A COMPUTER FILING SYSTEM TO DO?

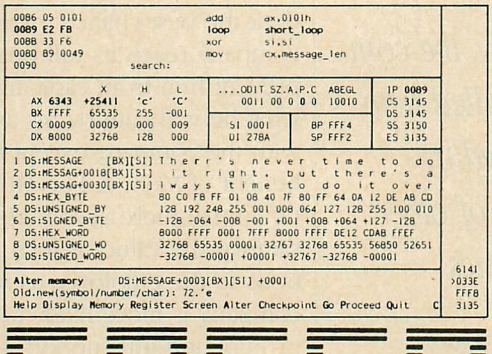
Use SeekEasy to organize magazine articles, photographs, record collections, appointments, etc.

For PC/MS-DOS 2.0/2.1 or CP/M-80 2.2. Available in 8" & most 5" formats — IBM PC, Kaypro, Epson, Televideo, Zenith, NEC, etc. Full program $87. Demo disk & manual $15, credited toward full program. Add 6.5% in CA. Add $3.00 S&H per order. VISA/MC welcome.

CORRELATION SYSTEMS
81 Rockinghorse Road, Rancho Palos Verdes, CA 90274
(213) 833-3462

CIRCLE NO. 116 ON READER SERVICE CARD

SCREEN



IBM PC SYMBOLIC DEBUGGER

- Watch highlighted changes on dynamic display
- Alter registers, flags, and memory
- Display data as decimal or hex or character
- Scroll through source listing
- Single-step program being debugged
- Execute procedures at normal speed
- Go to breakpoint at normal speed
- Interrupt execution on checkpoint conditions
- Use symbols and 8086 addressing modes

Requires:
IBM PC or PC/XT, PC/DOS 1.1 or 2.0, 64K RAM
IBM Assembler, Color or Monochrome Adapter

IBM is a registered trademark of International Business Machines, Inc.

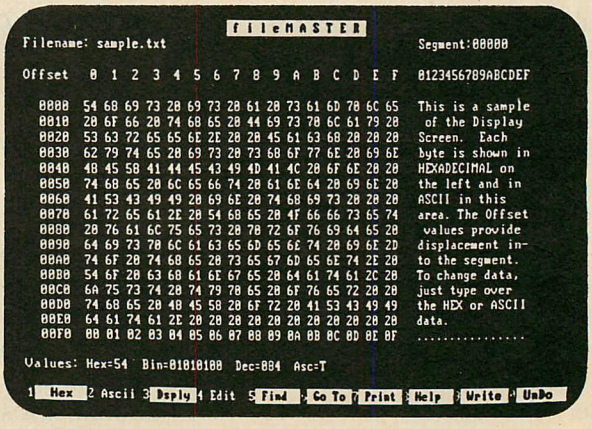
BUGSCREEN™
ONLY **$95**
Demo $7

RDT Software

Box 3216 • Lawton, OK 73502 • (405) 536-2078

CIRCLE NO. 167 ON READER SERVICE CARD

fileMASTER THE DISK UTILITY



FINALLY!! A Disk Utility for the IBM-PC that's fast and easy to use.

- FILE MODE
- DISPLAY
- PRINT
- MODIFY
- SECTOR MODE
- BROWSE
- SEARCH
- DOS 1.1 to 3.0

ONLY **$39.95** + $2.00 SHIPPING, CA + 6.5% TAX

J. L. SCHULLER & ASSOCIATES (818) 366-6934
14800 Rinaldi St., Suite 6, Mission Hills, CA 91345

CIRCLE NO. 164 ON READER SERVICE CARD

developing so quickly that it is difficult to imagine that the vice-president's insider information and contacts would continue to have value beyond a few years at the most) and would be unenforceable as against public policy (the public policy being that competition not be restrained unreasonably and that people not be precluded from using their skills to full advantage provided that the purpose is legal).

Public policy is determined by each state and varies widely in its balancing of the competing values of permitting employees to seek new employment as they choose and of protecting the employer's ability to develop the skills and knowledge of its employees without fear that they will be used by a competitor. Notably, a California statute declares noncompetition agreements unenforceable except in extraordinary circumstances (such as when given in connection with the employee's sale of a business to the new employer.)

What would be both sensible and enforceable (in most states) would be a so-called *covenant not to compete* or *noncompetition agreement*—an agreement that for a reasonable period of time the vice-president could not, directly or indirectly, have a financial interest in or work for a competitor within a reasonable geographic and market area. The time and market terms should be defined in the agreement and will, if reasonable, be enforced by the courts of most states. The court determines what is reasonable, depending on the particular circumstances. The more responsible the employee's position, the greater the likelihood that a given set of restrictions will be found reasonable. The higher the employee's salary, the greater the likelihood of enforceability. Courts give the employer greatest latitude in cases where the employee was hired in conjunction with the purchase of his ownership of a company—for example, where the employee built his own company, then sold it but remained its employee.

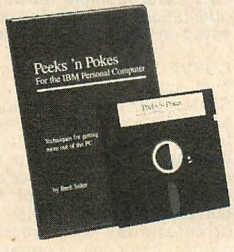
There are two general judicial approaches to the enforceability of covenants not to compete: under the *strict approach*, if the court finds that the restrictions were unreasonable, it will invalidate the entire covenant, leaving no restrictions on the employee; under the *blue-pencil* approach, if the court finds the restriction too severe, it may rewrite the agreement and place what it deems to be reasonable restrictions on the employee.

The possibility of a court's review of the noncompetition agreement must, of course, be considered. The more immediate consideration, however, is the employee's review—if he would agree to perpetual, absolute loyalty without

Know Thy PC!

Are you writing programs in BASIC or Pascal? The popular **Peeks 'n Pokes** has a disk with 58 programs and a 38-page manual that helps you get 'underneath the covers' of the PC. Learn how to use PEEK, POKE, INP, OUT, and DOS/BIOS function calls to do what you want, fast! Do you want to perform functions not available from BASIC or Pascal? It's all explained in the manual and demonstrated in the sample programs. Source code included!

Peeks 'n Pokes shows you how to:
- Access the system's configuration
- Unprotect BASIC programs
- Scroll part or all of the screen
- Access the file directory
- Logically swap printers
- Read and change the keyboard
- Find more Peeks and Pokes
- And much more...for only $30.00



Want to know more? **The Inside Track!** is a collection of advanced utilities for the PC programmer. It contains a disk with 61 programs, a 42-page manual, and a fold-out memory map that helps you get better performance from the PC. With this package you can give your programs assembler-assisted speed from high-level languages, get control over memory, customize and control the PC, and more. Some programs require DOS 2.00. Source code included!

The Inside Track! shows you how to:
- Read/write files as fast as DOS
- Display data on the screen faster
- Reserve memory for your use
- Copy memory to another location
- Copy-protect your programs
- Load large programs faster
- Control the keyboard settings
- And much more...for only $45.00

MasterCard and VISA accepted. Shipping charges: $2.50 per order for UPS; $2.50 per item for First Class Mail to USA and Canada; $6.00 per item for Air Mail outside USA and Canada. Dealer inquiries invited.

Data Base Decisions • 14 Bonnie Lane • Atlanta, GA 30328 • 404/256-3860

CIRCLE NO. 137 ON READER SERVICE CARD

Even If You Don't Have The 8087...

debug8

from RollinSoft

➪Extends & enhances the power of DEBUG by adding complete support for the 8087 numeric coprocessor.
➪Register values are displayed with 18-digit floating-point accuracy.
➪Status, Tag, and Control words are identified.

PLUS!

➪Enter decimal values directly into any 8087 register. Initialize the 8087 with one command.
➪Requires DOS 2.x DEBUG.

New Commands

- **K** clear screen, set screen mode, attribute, and border
- **B** binary and decimal conversions
- **H** Hexarithmetic with 6 operations
- **Y** one-step trace of CALL, INT, LOOP and REP. One-line trace display.
- **X** 8087 npX display and modify
- ***** timer-interrupt, FWAIT bugs fixed

Rush $49.95 to:
RollinSoft PO Box 12147, La Crescenta CA 91214
Created by Dan Rollins

CIRCLE NO. 229 ON READER SERVICE CARD

Announcing a

TOTAL PARSER GENERATOR

<GOAL> :: = <RAPID> <COMPILER> <DESIGN>

SLICE YOUR COMPILER DEVELOPMENT TIME

An LR(1) parser generator and several *sample compilers*, all in Pascal for your microcomputer.

- Generates parser, lexical analyzer and skeleton semantics
- Universal, error recovery system
- Adaptable to other languages and computers
- Interactive debugging support
- Thorough documentation
- TURBO PASCAL™ INCLUDED FREE OF CHARGE
- Includes mini-Pascal compiler, assembler, simulator in SOURCE

SPECIAL INTRODUCTORY OFFER $ 995

QPARSER™ runs on IBM PC/DOS in Turbo Pascal. Parser generator in object form; all else in source. QPARSER takes a grammar and generates a correct, complete, high-performance compiler with skeleton semantics in Pascal source. Easy to add full semantics for YOUR application. Excellent for industrial and academic use. An accompanying textbook (SRA publishers) available in 1985. Training can be arranged. Demo disk available for $50.

Educational and quantity discounts available. Check, money order, Mastercard, Visa. California residents add 6.5% sales tax.

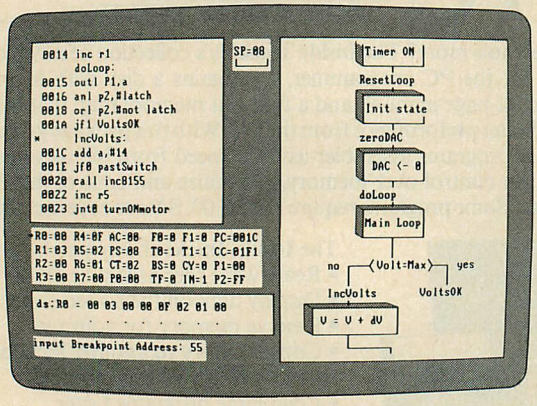
WRITE OR CALL FOR FREE BROCHURE.
Technical details: call 408/255-5574. Immediate delivery. CALL TODAY!

QCAD SYSTEMS, INC.
1164 Hyde Ave., San Jose, CA 95129
TOLL FREE: 800-538-9787
(California residents call 408/255-5574)

™ Turbo Pascal is a registered trademark of Borland International.

CIRCLE NO. 158 ON READER SERVICE CARD

Simulator/Debugger for IBM-PC for 8048 - 8051 - 7000 µCs



Execute and debug code for popular single chip microcomputers on your IBM PC. Dynamic display with windows for source code, control flow, registers, flags, memory, commands, and more! Set breakpoints, traps, etc. Cross-assembler & EPROM programmers, too.

	8048	8051	7000	Z8	
X-Assembler	✓	✓	✓	✓	$195
EPROM Prog	✓	✓	✓	✓	$245
Simulator	✓	✓	✓		$395

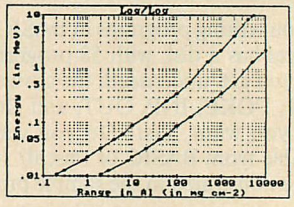
Demo disk and manual for simulator only $39.50

Cybernetic Micro Systems
Box 3000 • San Gregorio, California 94074 U.S.A.
(415) 726-3000 • Telex 171-135 Attn: Cybernetics

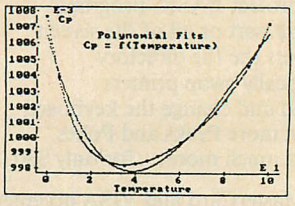
CIRCLE NO. 136 ON READER SERVICE CARD

Professional Lab and Business Graphics Software for Your IBM* PC

SCIENTIFIC PLOTTER-PC—Draws professional graphs of your data. Line or scatter plots, semi-log or log-log plots, bar graphs, exploded pie charts, stock charts with high, low, close. 320 x 200 resolution in 4 colors. Automatic or manual selection of axis length and position, tick marks and numeric labels. Features 20 plot symbols, error bars, multiple labels in 4 orientations and versatile printer hardcopy. Format and data files may be saved on disk. Includes 11 demos on disk plus manual .....$ 95



CURVE FITTER-PC—Select the best curve to fit your data. Scale, transform, average or smooth, interpolate (3 types), least squares fit (8 types), evaluate unknowns from fitted curves. Features auto-scaling, statistical evaluation of fitted curves, multiple labels in 4 orientations, and versatile printer hardcopy. Format and data files may be saved on disk. Includes 5 demos on disk plus manual .....$ 95



SPECIAL: SCIENTIFIC PLOTTER-PC and CURVE FITTER-PC—on 1 disk **$175**

Add $2.50 shipping on all U.S. orders. VISA or MASTERCARD orders accepted.

*Trademark of International Business Machines, Inc.

™ imi **INTERACTIVE MICROWARE, INC.**
P.O. Box 139, Dept. 237
State College, PA 16804

Phone: (814) 238-8294 • Telex: 705250

CIRCLE NO. 159 ON READER SERVICE CARD

reservation, perhaps the company should reconsider its choice. The company and the employee should agree on a reasonable period following the termination of their relationship during which time the employee could not work for a competitor. Given the rapid development of the industry, it would be surprising if the employee would agree to more than a few years; given the potential importance of a key person in the industry, it is unlikely that the employer would accept less than one year.

The limitation period should have some exceptions, such as the bankruptcy of the company. Other exceptions, such as the sale of the company, will present a more difficult problem—the employee may prefer to work for a small company and want the right to work elsewhere if his employer suddenly becomes part of a conglomerate; the employer, however, may be unable to sell the company unless he can deliver to the potential purchaser an intact team and some promise of at least temporary protection from employee defections.

Reaching an agreement on an absolute time period may be difficult, and the solution may be to tie the noncompetition agreement to other elements of the employment arrangements. For example, if the employee is entitled to bonuses, the level of the bonuses might be increased if he met certain noncompetition conditions (or decreased if he did not, provided that the provision is structured so as not to violate the requirements of state or federal pension laws).

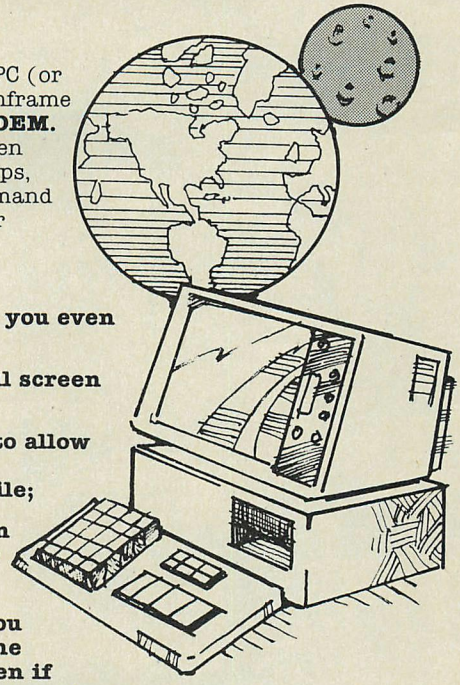
Another approach might be to continue all or a portion of the employee's salary during the period in which he agrees not to work for a competitor—for example, the employer might agree to pay the difference between the employee's old salary and a lower salary he was forced to accept by virtue of being foreclosed from accepting competitive employment. During the term of the agreement, it would be most helpful if the employee were obligated to advise the employer whenever he changed jobs, so that the employer could make a judgment on the compliance with the agreement.

The subject of a covenant not to compete should be raised immediately with any employee who holds a position of trust. Furthermore, the employer should not be thinking only about negotiating such a covenant; he should also be determining whether or not the prospective employee is already under similar obligations to a previous employer. After all, other people do read this column.

TALK TO THE WORLD WITH TELIOS.™

The best asynchronous communications package keeps getting better.

TELIOS™ Version 2.0 let your IBM PC (or plug-compatible) function as a mainframe terminal using **KERMIT** and **XMODEM.** It let you use full memory as a screen buffer, transfer files at up to 9600 bps, define function keys, establish command files, use selected **DOS** commands or check parameter status without interrupting communications.



Now TELIOS™ Version 3.0 gives you even more:

- **DEC/VT-100 and DEC/VT-52 full screen emulation;**
- **Command file enhancements to allow parameter passing, logic, and queueing with the command file;**
- **Definition of 10 more function keys in addition to the full 10 supported by TELIOS™ 2.0;**
- **A STORE command that lets you selectively save material in the screen buffer to a disk file even if a capture-to-disk was not set up; and**
- **A renaming feature that will prevent existing files from being overwritten by new files given the same name.**

For more information about what TELIOS™ 3.0 can do for you, talk to Genasys Corporation. We can help you talk to the world more easily than ever before.

Your future begins with

genasys®

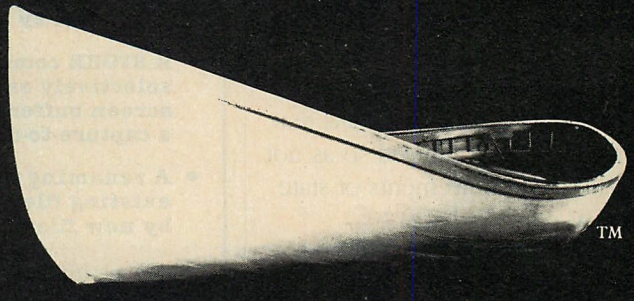
11820 Parklawn Drive
Rockville, MD 20852
(301) 770-4600

IBM® PC is a trademark of International Business Machines. Requires 96K.

DEC/VT-100 and DEC/VT-52 are registered trademarks of Digital Equipment Corporation.

CIRCLE NO. 138 ON READER SERVICE CARD

C Is The Language.
Lifeboat Is The Source.



Lifeboat.™
The Leading Source And Authority For Serious Software.
1-800-847-7078.
In NY State: 212-860-0300

Serious Software For The C Programmer From Lifeboat.™

Lattice® C Compiler: *The serious software developer's first choice.*

Selected for use by IBM,® Texas Instruments, Wang,® MicroPro,® Ashton-Tate,™ IUS/Sorcim,® Microsoft® and Lotus™ to name a few of the many. Why? Lattice C is clearly the finest 16 bit C compiler available today.

—Renowned for speed and code quality.
—Fully compatible with the C standards set forth by Kernighan and Ritchie.
—Four memory model options offer you unsurpassed control and versatility.
—Superior quality documentation.
—Now includes automatic sensing and use of the 8087 chip.
—Widest selection of supporting add-on packages.

Halo™: *A graphics development package rapidly emerging as the industry standard.*

—140 graphics commands including plot, line, arc, box circle and ellipse primitives, bar and pie charts; pattern fill and dithering commands.
—New: multiple viewports and "stroke text" for angling, scaling and filling text.

C Food Smorgasbord™: *This beautifully written collection of C functions is a valuable time saver.*

—Library includes a binary coded decimal arithmetic package, level 0 I/O functions, a terminal independence package, IBM PC ROM BIOS access functions and much more.

Pmate™: *The premier editor for the programming professional.*

Pmate is a full screen editor with its own powerful macro command language:

—Perform on screen row and column arithmetic, alphabetize lists, translate code from one language to another, call up other macros.
—Customize Pmate almost any way you like.
—Contains 10 auxiliary buffers for storage of macros, text, subroutines.
—An "undo" feature allows the programmer to retrieve whole series of deleted items.

Additional C Tools Available From Lifeboat:

Panel™: Screen formatter and data entry aid.
Lattice Windows™: Windowing utility; create "Virtual Screens."
Plink-86™: The popular linker; includes extensive overlay capabilities.
Pfix86™: Dynamic debugging utility.
Pfix86 Plus™: Symbolic debugger with capacity to debug overlays.
Btrieve™: Database record access/retrieval library.
Phact: Multikeyed ISAM C-Function library.
Fabs: Fast access B-tree database function library.
Autosort: Fast sort/merge utility.
ES/P: 'C' program entry with automatic syntax checking and formatting.
Greenleaf Functions™: Library of over 200 popular C functions.
And much more.

YES! Please rush me the latest FREE Lifeboat™ catalog of C products.

*Company Name*_____ *Business Phone*_____

*Name*_____ *Title*_____

*Address*_____

*City*_____ *State*_____ *Zip*_____

Please check the category where Lifeboat can best help you:

☐ *Software development* ☐ *Corporate* ☐ *Education*
☐ *Dealer/distributor* ☐ *Government* ☐ *Other*_____

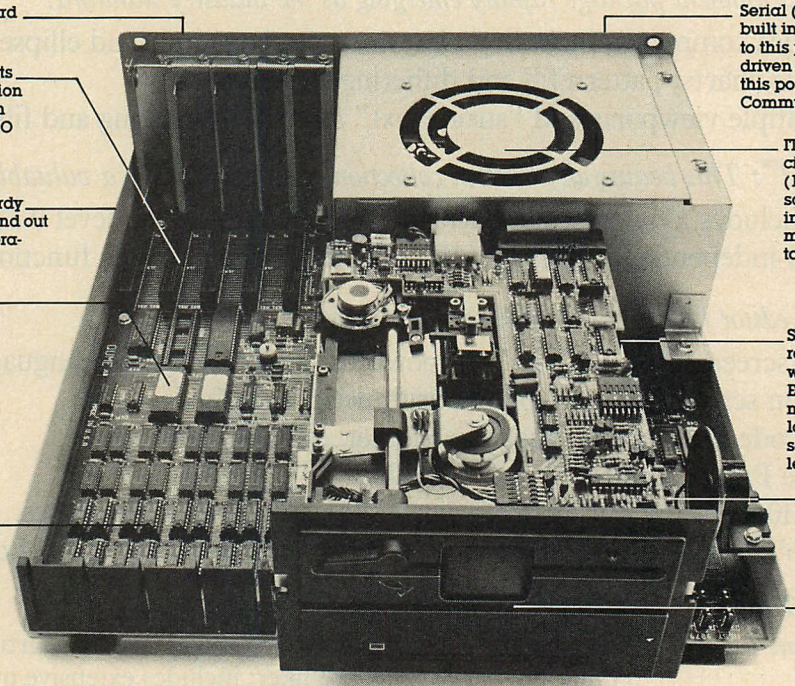
Call Direct: 1-800-847-7078 (In NY State: 212-860-0300)
Return coupon to: Lifeboat Associates™
1651 Third Avenue, New York, NY 10128.

TJ112

© 1984 INTERSOFT CORPORATION

CIRCLE NO. 139 ON READER SERVICE CARD

NO GUTS, NO GLORY.



Parallel port included. Standard interface for popular printers.

Five full-length expansion slots for IBM PC/XT compatible option cards. Hard disk machine with 640K, real time clock, three I/O ports and display has two slots free.

Small overall dimensions, sturdy metal case, designed inside and out with horizontal or vertical operation in mind.

ROM BIOS AND MONITOR by ITT: Interrupt compatible with IBM PC/XT and more. Ever-ready menu-driven, diagnostic monitor debugger. Test hardware device by device and channel by channel. Examine registers, alter or dump memory, read or write tracks and sectors. Even set drive timing.

256K byte, parity-checked RAM on planar board. Combo board with one, two and three banks of 128K bytes each. Real time clock and parallel port also available to give 640K RAM total with only one slot used.

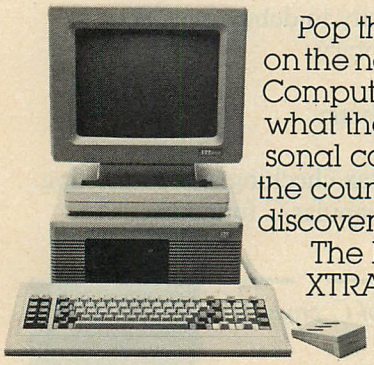
Serial (RS-232) communications port built in. Console I/O may be redirected to this port by switch setting. Menu-driven DOS utility (set up) to configure this port or redirect printer I/O to it. Communications program included.

ITT's own heavy duty, high efficiency, switching power supply (115 watts continuous service) saves weight without compromising support for fully-equipped machines. 95 to 132 volts or 180 to 240 volts.

Switch controls allow console I/O redirection to serial port—use whatever ASCII terminal you want. Enable/disable power-on memory test for faster starts on large machines. Enable/disable screen-saving blanking when left idle.

Floppy disk controller on planar. Saves a slot.

Space-saving half-height disk drives.



Monitor conveniently tilts and swivels. Green, amber or color. Three-position keyboard. Our very own, fully-supported ITT Mouse.

Pop the rugged metal case on the new ITT XTRA™ Personal Computer and you'll find what thousands of our personal computer users across the country have already discovered.

The beauty of the ITT XTRA Personal Computer is definitely more than skin deep.

In fact, it runs all the way down to the very last power supply winding.

This is one of the most cleanly designed, most extraordinarily simple machines to come along in quite awhile.

We modestly consider it the finest personal computer compatible on the market.

An example. Where IBM has BIOS support routines for its BASIC, we have a ROM monitor and diagnostics utility that's always available, provides direct disk access and isolates problems right down to the chip level.

It's a finely crafted, expertly engineered machine that's predictable, reliable and a pleasure to use.

We've taken great pains to provide all the right guts.

We leave all the glory to you.

ITT
PERSONAL COMPUTERS

IBM PC and XT are registered trademarks of International Business Machines.

HELPING AMERICA WORK SMART.

For more information, or the location of your nearest ITT authorized dealer, call 1-800-321-9872.

© 1984, ITT Information Systems

CIRCLE NO. 212 ON READER SERVICE CARD

Turbo Pascal

PC Tech Journal's product of the month for January 1985 is Borland International's Turbo Pascal compiler. Turbo Pascal is recognized for its high performance, clear documentation, and approachable cost. These factors, combined with Borland's recognized highly responsive end-user policy, have quickly transformed Turbo into the "People's Pascal."

Turbo Pascal includes all the necessary program development tools in one smoothly integrated and bug-free package. The editor, compiler, and run-time system operate within a consistent and well-engineered environment. All aspects of execution are blindingly fast, particularly when they are compared to other compilers that require multiple passes plus a link step and, of course, a stand-alone program editor. The documentation, if not elegant, is clearly written and well-organized.

Turbo Pascal's full-screen editor is supplied with WordStar-compatible control functions, but Borland has thoughtfully supplied an installation program with which the user can tailor the editor. Once a program has been entered, a single keystroke invokes the compilation step. The compiler flags language syntax errors by suspending compilation and returning automatically to the editor with the cursor pointing to the probable location of the error. Run-time errors are handled with similar magic.

In addition to its being intelligently designed, the package of language extensions that are incorporated into Turbo Pascal permits a degree of hardware portability that is rarely found in language systems. For example, the screen control unit has been standardized so it is possible to take a Turbo Pascal program and compile it on any machine that is able to run CP/M-80, CP/M-86, or MS-DOS, regardless of the specific machine's screen-addressing requirements.

PRODUCT NAME
Turbo Pascal

COMPANY
Borland International

ADDRESS
4807 Scotts Valley
Scotts Valley, CA 95066

TELEPHONE
1-800-255-8008
1-800-742-1133 (in California)

PRICE
$49.95

with 8087 support
$89.95

1.0 to 2.0 update
$29.95 plus original master

1.0 to 8087 update
$69.95 plus original master

Extensions to the standard ISO Pascal language definition include the following:

- 8087 support
- Overlays and program chaining
- Color, graphics, and sound support
- In-line machine code
- PC-DOS function calls
- User-defined device drivers
- Simplified file-handling routines
- Direct access to absolute and relative memory locations
- Windowing support

The program is also flexible. Options at the main menu allow a user to allocate dynamic memory according to the applications program's requirements. Another opton directs compiler output to either memory or a disk .COM file. This feature highlights one of the more stellar qualities of Turbo Pascal: interactivity. A program can be written, debugged, and groomed with the ease of an interpreter-based environment, then compiled to a disk .COM file for stand-alone applications.

Its minor limitations notwithstanding, Turbo Pascal is an outstanding program development tool for all but the most sophisticated of applications. In typical fashion, Borland International's second version of the package improved on the original release in significant ways. The popularity of the product keeps third-party suppliers rushing in order to provide ever more features and functions for the Turbo Pascal programmer.

An excellent choice for program development with a rather amazing price/performance ratio, Turbo Pascal continues to show itself to be a unique package in the IBM PC language arena.

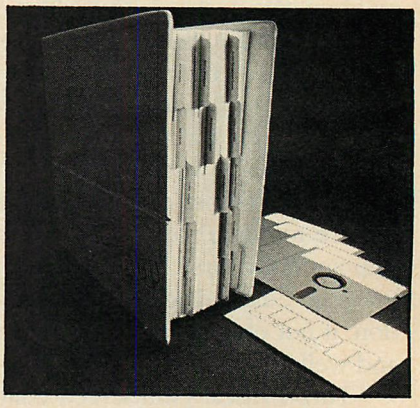
For your IBM/PC

mbp COBOL: 4 times faster, and now with SORT & CHAIN.

$750.

mbp COBOL can be summed up in one word: fast.

Because it generates native machine language object code, the mbp COBOL Compiler executes IBM/PC* programs *at least* 4 times faster (see chart). Fast also describes our **new SORT**, which can sort four-thousand 128-byte records in less than 30 seconds. A callable subroutine or stand-alone, 9 SORT control fields can be specified. And our **new CHAIN** is both fast and secure, conveniently transferring control from one program to another, passing 255 parameters. Plus, **new extensions** to ACCEPT & DISPLAY verbs give better, faster interactive programming.



GIBSON MIX Benchmark Results
Calculated S-Profile
(Representative COBOL statement mix)
Execution time ratio

mbp COBOL	Level II** COBOL	R-M*** COBOL	Microsoft**** COBOL
1.00	4.08	5.98	6.18

128K system with hard disk required. *IBM/PC is an IBM TM; **Level II is a Micro Focus TM; ***A Ryan-McFarland TM; ****A Microsoft TM.

The complete COBOL.

An Interactive Symbolic Debug Package included standard; Multi-Keyed ISAM Structure; listing options allow source & object code, map & cross-reference checking; GSA Certification to ANSI '74 Level II; mbp has it all.

It's no surprise companies like Bechtel, Chase, Citicorp, Connecticut Mutual, and Sikorsky choose mbp COBOL; make it your choice, too. mbp is available at Vanpak Software Centers, or direct; just send the coupon, or call for complete information—today.

mbp COBOL: 4 times faster.

CIRCLE NO. 165 ON READER SERVICE CARD

mbp Software & Systems Technology, Inc.
7700 Edgewater Drive, Suite 360, Oakland, CA 94621
Phone 415/632-1555

Please send complete mbp COBOL information to:

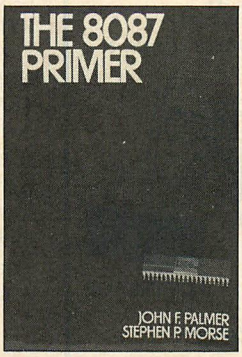
NAME _____

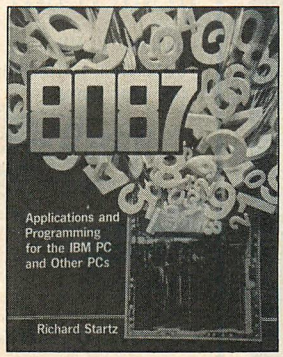
COMPANY _____

ADDRESS _____

CITY/STATE/ZIP _____

PHONE _____





The 8087 Primer
John F. Palmer and Stephen P. Morse
(Wiley Press, New York, NY, 1983)
182 pages; paper, $16.95

8087: Applications and Programming for the IBM PC and Other PCs
Richard Startz
(Robert J. Brady Co., Bowie, MD, 1983)
276 pages; paper, $22.95

There are only two ways to use the power of Intel's 8087 math coprocessor chip: make use of prewritten support libraries included with many language compilers and interpreters or bear down and write your own support routines in 8086/87 assembler. By using canned libraries you can treat the 8087 as a black box; but if you want to "roll your own," you must know the workings of that black box *intimately*.

The Intel product literature for the 8087 may help you if you are a seasoned 8086/88 assembly-language programmer. The Intel documents are like most vendor-published microprocessor documents: they *state*, but they do not *explain*. In order to learn the 8087 from the ground up, you need a good book and a chance to play.

The 8087 Primer by John F. Palmer and Stephen P. Morse would seem to have the inside track: Morse designed the 8086 and Palmer designed the 8087. The book was designed to be a companion volume to Morse's earlier book, *The 8086 Primer*, which I found to be a reasonable introduction to the 8086.

The 8087 Primer is divided into three parts: an overview of the 8087, a detailed discussion of its architecture, and an 8087 programming tutorial. The overview is by far the best part of the book. Most of the trick in understanding the 8087 lies in understanding the problems of expressing real numbers as collections of bits, along with the problems of rounding, division by zero, and infinities. Palmer spends a lot of time with these issues, covering them thoroughly. The overview of 8086/87 interface is also well done; it does not bury the reader in details. Without a feel for how the 8087 works together with the 8086, trying to understand how the 8087 works itself is hopeless.

Once into the section on the 8087's architecture, Palmer started to lose me. In part it was due to the compression of the information. This small book covers a topic as dense as any in personal computing. Moreover, Palmer's writing does little to make this brutal subject comprehensible to the uninitiated.

A sample sentence: "To be sure of safe treatment of infinities, we should make sure that the 8087 is in its projective mode of infinity arithmetic (since the sign of the infinity result in this case is determined by whether we are dividing by plus zero or minus zero, which in turn may be an accident of some previous roundoff.)"

For a reader who may still be reeling from the very notion of plus zero or minus zero (not to mention wrap-around infinities), this is quite a heavy piece of text to digest.

The final section on programming completely cops out: Palmer spends most of this section explaining how to program in FORTRAN. This must be filler; it says nothing at all about how FORTRAN interfaces to the 8087 internally. It is simply a lesson in entry-level FORTRAN. A programmer who managed to survive this section with its 80-bit registers and NAN (Not A Number) flags will hardly require two whole pages explaining logical IF statements.

At the end of the next section is a short lesson on assembly-language programming. In a spare 12 pages it says very little that will help a programmer write his own 8087 support library. What it does say is tied closely to Intel's own 8086 assembler, ASM-86, so is not of much use for people using the Microsoft macroassembler on the PC.

I have been attributing *The 8087 Primer* to Palmer all along because Morse is a much better writer than the prose would indicate. I suspect Morse acted mostly as an 8086/88 consultant on the book. His own style, which I enjoyed so much in *The 8086 Primer*, is nowhere to be found.

At $16.95, this is an expensive book just for the overview. Sadly, I cannot recommend it in light of there being a much better book from Brady Communications, Inc.: *8087*, by Richard Startz.

To the extent that *The 8087 Primer* is general and theoretical, *8087: Applications and Programming for the IBM PC and Other PCs* is a roll-up-your-sleeves-and-do-it book, focusing on the IBM PC and the PC Macro assembler. This is not to imply that it is an *easy* book, but it has more to offer the programmer than *The 8087 Primer*.

Startz begins by explaining what the 8087 can do and when it should be used, along with some benchmarks comparing the 8087's performance to that of other micros and some formidable mainframes, including the VAX and DEC 20 series. From there it plunges into the 8087's jungle of registers and bit-mapped mathematics. I personally could have used a little more overview and a lot more diagrams.

Because the 8087 cannot be used without the 8088, Startz includes a beginner's tutorial on programming the 8088 in assembly language. I would not leave a beginner with this tutorial and nothing else to go on, but as a review, it is nicely done, especially because it covered only those aspects of 8088 necessary to work with the 8087.

One problem with the book is its neglect of a large portion of its potential audience. High-level language inter-

"This is a beautifully documented, incredibly comprehensive set of C Function Libraries."
— Dr. Dobb's Journal

COMPLETE SOURCES

- **PACK 1: Building Blocks I** $149
  250 Functions: DOS, Printer, Video, Asynch
- **PACK 2: Database** $399
  100 Functions: B-Trees, Variable Records
- **PACK 3: Communications** $149
  135 Functions: Smartmodem™, Xon/Xoff, Modem-7, X-Modem
- **PACK 4: Building Blocks II** $149
  100 Functions: Dates, Text Windows, Pull-down Menus Data Compression
- **PACK 5: Mathematics I** $99
  35 Functions: Log, Trig, Square Root
- **PACK 6: Utilities I** $99
  Archive, Diff, Replace, Scan, Wipe (Executable Files only)

Lattice™, Microsoft™, DeSmet™, CI-86™ Compilers on IBM PC/XT/AT™
Small and Large Memory Models.
Credit cards accepted
($7.00 handling/Mass. add 5%)

SOFTWARE HORIZONS INC.
165 Bedford Street
Burlington, Mass. 01803
(617) 273-4711

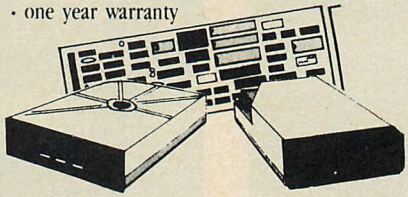
NOVUM ORGANUM

CIRCLE NO. 175 ON READER SERVICE CARD

Creative Edge **$749**

10 MB HARD DISK

- includes 10 MB drive, controller, cables, & installation instructions
- one year warranty



EDGE ADVANTAGE

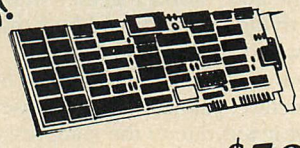
Creative Advantage

5 MB REMOVABLE HARD DISK **$995**

- plated removable media
- low power, ½-height design
- includes drive, cartridge, controller, cables & installation instructions
- ideal for additional storage and backup
- one year warranty

EDGE/ADVANTAGE..... $1695

NEW!



COLOR 400 **$595**

- 16 Color, 640x400 non-interlaced display
- Runs Lotus 123, Supercalc, etc. at twice their normal resolution
- Separate character sets for emulation and high resolution modes

SIGMA DESIGNS

COLOR 400 W/MOUSE... $ 695
COLOR 400 W/SR-12..... $1185
10 MB HARD DISK ..... $ 895
EXPANSION CHASSIS.... $ 695
2.6MB MEGA FLOPPY ... $ 749
45MB TAPE BACK-UP.... $1195

Multifunction Board w/64K..... $249
Monochrome Card $199
Color Adapter $189
Floppy Controller..... $159
HAYES 1200 Smartmodem..... $469
HAYES 1200B w/Smartcom II $419

Write or Call For Our Free Product List

Creative Microsales
171 Mayhew Way, Suite 211
Pleasant Hill, CA 94523
(415) 945-1201

OUTSIDE CALIFORNIA CALL TOLL FREE

800-321-3324

CIRCLE NO. 125 ON READER SERVICE CARD

face examples, when given, focus on interpreted and (mostly) compiled BASIC. I would like to have seen even brief examples of 8087 interfaces to IBM FORTRAN and IBM PASCAL, both of which are heavily used for math-intensive scientific programming. The author's coverage of 8087 interface to BASIC, however, is complete and very detailed, including printer dumps of DEBUG sessions, including handwritten marginal comments and explication.

The last several chapters of the book are most certainly the hardest to approach for a person not thoroughly steeped in engineering math. Startz covers 8087 applications in linear systems and matrix inversion, including assembly-code implementations of Crout decompositions of matrices. He works briefly with solving non-linear functions with the 8087, and finally offers a 500-line statistical analysis program in BASIC which relies on the 8087.

8087's index is superb, a model of what a microcomputer book index ought to be, but rarely is. I had hoped for a glossary (for quick reference to the various wraiths that live inside the 8087) but none was included.

This is a rough subject, and *8087* is a rough book. In the introduction, Startz says. "The 8087 isn't just fast, it's very easy to use." This, however, is not so, not by a long shot. Without a firm grounding in both mathematics and 8088 assembly language, you will go nowhere with this book.

But that is not the book's fault. Within those areas of the book where the math did not swamp me, Startz showed himself to be an able explainer, at ease with both his subject and the English language. The diction is conversational and does not get in the way of the subject. The typeface of the book itself is set in small and tightly set, which is rough on the midnight reader. Retypeset and spread out a little, the book would be much more attractive and less tiring to read. As an adjunct to the book, Brady Communications offers all the program listings (both source and object) on IBM PC diskette for $30. For the statistical analysis program alone, that is probably a good buy.

Not many people are going to write books on the 8087. Not many people understand it well enough to use it, much less understand it well enough to *teach* it. Richard Startz's *8087* should grow to be a classic in its very narrow field. When I need to know something about the 8087 in the future, this is the book I will reach for.

—JEFF DUNTEMANN

PC LINK

INDEPENDENT STORE IN NYC DEDICATED TO IBM® PC SOFTWARE AND PERIPHERALS ONLY

STORE HOURS: 9:00 A.M.–5:30 P.M. E.S.T. MON.–FRI.
Saturdays 10 A.M.–4 P.M.
Terms, conditions and prices differ in our store.

PC LINK, CORP. 29 WEST 38TH ST. 2ND FL., NEW YORK, NY 10018

SPECIALS OF THE MONTH EFFECTIVE JAN. 1st through 31st

PRINCETON GRAPHICS
HX-12 RGB Monitor $449.00

NEC
3550 Daisy Wheel
Letter Quality Printer $1349.00

NAME BRAND
64K Ram Chips $35.00

BUSINESS SOFTWARE

ALPHA SOFTWARE
DATA BASE MANAGER II $205.00
TYPE FACES 89.00
ELECTRIC DESK 249.00

ASHTON–TATE
dBASE III ..... CALL
FRAME WORK ..... CALL

BORLAND INT.
SIDEKICK 39.00
TURBO PASCAL 39.00

CONTINENTAL
HOME ACCOUNTANT PLUS 89.00
TAX ADVANTAGE 45.00
PROPERTY MANAGEMENT 319.00

ENERTRONICS
ENERGRAPHICS ..... CALL

FRIENDLY SOFT
FRIENDLY WRITER 60.00

FOX & GELLER
QUICKCODE III 159.00
OZ ..... CALL

HARVARD SOFTWARE
HARVARD PROJECT MANAGER ..... CALL

HAYES
SMARTCOM II 95.00

I U S
ACCOUNTING PACKAGES 4.0 ..... CALL
EASYWRITER II PLUS ..... CALL

LOTUS DEVELOPMENT CORP.
LOTUS 1-2-3. (No Mail Or Phone Orders) CALL
SYMPHONY (No Mail Or Phone Orders) CALL

MECA
MANAGING YOUR MONEY 129.00

MICRO DATA BASE
KNOWLEDGE MAN ..... CALL

MICRO PRO
WORDSTAR 2000 PLUS ..... CALL

MICRORIM
R BASE 4000 ..... 309.00

MICROSOFT
MULTIPLAN 139.00
PROJECT 179.00
WORD 235.00
COMPILERS ..... CALL

MICROSTUFF
CROSSTALK 105.00
TRANSPORTER 169.00

MORGAN COMPUTING
PROFESSIONAL BASIC 89.00

NORTH AMERICAN BUSINESS
MEMORY SHIFT 69.00

NORTON COMPUTER
NORTON UTILITIES 3.0 ..... 69.00

PC SOFTWARE
CREATABASE 65.00

PALSOFTWARE
ARTPAK 69.00

PEARL SOFT
PERSONAL PEARL ..... CALL

REMS SOFTWARE
REAL ESTATE INVESTOR II 225.00

ROSE SOFT
PROKEY 3.0 ..... 89.00

STSC
APL*PLUS ..... CALL

SATELLITE SOFTWARE
WORD PERFECT 269.00

SAWHNEY SOFTWARE
TAX MODE ..... CALL
PLAN MODE ..... CALL
FOR PLAN MODE, STATE MODULES
INCLUDING CALIFORNIA, NY, NJ .... CALL

SOFTWARE GROUP
ENABLE (No Mail Or Phone Orders) CALL

SOFTWARE PUBLISHERS
PFS SERIES ..... CALL

SOFTWARE SYSTEMS INC.
MULTIMATE 299.00

WARNER SOFTWARE
THE DESK ORGANIZER ..... CALL

XY QUEST
XY WRITE II PLUS 249.00

DISK DRIVES
IOMEGA BERNOULLI BOX 20MB 2975.00
QUME T142 ..... CALL
SYSGEN ..... CALL
TANDON TM 100-2 ..... 175.00

MULTIFUNCTION BOARDS
64 RAM CHIPS ..... SEE SPECIAL
AST CARDS ..... CALL
QUADBOARD CARD øK 229.00
PC MOUSE ..... CALL
ORCHID BLOSSOM BOARD 199.00
PLANTRONICS COLOR PLUS CARD ... CALL
HERCULES ..... CALL
HELIX BUBBLE MEMORY ..... CALL
TECMAR GRAPHIC MASTER 489.00

ENTERTAINMENT & EDUCATION
ACROSS THE USA 25.00
ATI TRAINING PACKAGES ..... ea. 55.00
ATTACK ON ALTAIR 29.00
BIG TOP 27.00
CONQUEST 29.00
COSMIC CRUSADERS 27.00
DEADLINE 37.00
DIGGER 29.00
THE EXTERMINATOR 29.00
FLIGHT SIMULATOR–NEW VERSION .. 35.00
FRIENDLY ARCADE 29.00
FRIENDLY PC INTRO SET 29.00
FROGGER 25.00
HI RES #4 ..... 27.00
KID STUFF 32.00
MASTER MINER 27.00
MILLIONAIRE 49.00
MOON BUGS 29.00
MY LETTERS, NUMBERS & WORDS ... 32.00
PC CRAYON 39.00
INTRO TO OPERATING SYSTEM 49.00
PLANET FALL 39.00
SERPENTINE 25.00
SNACK ATTACK 27.00
SPINNAKER SERIES ..... CALL
SUSPENDED 39.00
WITNESS 39.00
WIZARDRY 39.00
ZORK I, II, III ..... ea. 27.00
ZURAN DEFENDER 25.00

ACCESSORIES
CURTIS PRODUCTS
DISPLAY PEDESTAL 35.00
MONO CABLE 38.00
KEYBOARD CABLE 30.00
SYSTEM STAND 17.00
COLOR CABLE 45.00
SURGE PROTECTORS ..... CALL
KRAFT JOYSTICK 39.00
HAYES MACH III JOYSTICKS 45.00
KEYBOARD DRAWER 75.00

KEYTRONICS
KB 5151 KEYBOARD 189.00

MONITORS
AMDEK 310A $175.00
PRINCETON GRAPHIC HX-12 .... SEE SPECIAL
SR-12 ..... CALL
MAX-12 ..... 179.00
ZENITH RGB MONITOR 479.00

MODEMS
HAYES SMART MODEM $205.00
HAYES SMART MODEM 1200 ..... 479.00
HAYES SMART MODEM 1200B 419.00
RACAL VEDIT MAXWELL MODEM 1200 CALL

DISKETTES

	SS/DD	DS/DD
CATALINA TECHNOLOK		24.00
DYSAN	24.00	34.00
MAXELL	20.00	29.00
VERBATIM	22.00	31.00
VERBATIM HEAD/CLEANING KIT		10.50

PRINTERS
DIABLO 630 API $1599.00
DIABLO 630 TRACTOR FEED 249.00
DYNAX DX-15 ..... 389.00
BROTHER 25/35 ..... CALL
OKIDATA 92P / 93P / 84P ..... CALL
TOSHIBA P1351 ..... 1269.00
EPSON FX SERIES ..... CALL
NEC 3550 ..... SEE SPECIAL
PRINTER CABLE/PARALLEL 25.00

CORPORATE ACCOUNTS POLICY

We honor purchase orders from major corporations listed on stock exchanges, governmental agencies and universities.

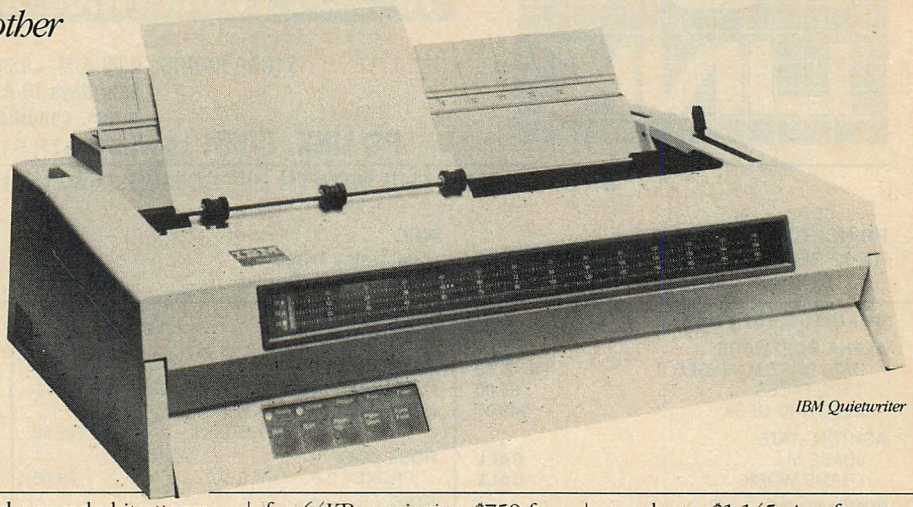
PLEASE ADD 10% to the listed prices for purchases with purchase orders.
OUR TERMS ARE NET 10 DAYS.
It is our policy not to advertise names of corporations who purchase from us.

CALL TOLL FREE 800-221-0343 All prices listed in this ad are effective Jan. 1-31, 1984. All Brands are Registered Trademarks. IBM is a Registered Trademark of IBM Corp. **IN NEW YORK CALL 1-212-730-8036**

TERMS AND CONDITIONS

We reserve the right to repair, replace or return to manufacturer for repair, all goods acknowledged faulty or damaged on receipt by customer. ***Customer must call for Return Authorization Number before returning any goods.*** Prompt attention will be given to all damaged and faulty returned goods. Any goods returned for credit are subject to 10% restocking charge, plus shipping charge. No returns for credit on any software. Customer must deal with the manufacturer directly if the customer finds any false claims made by the manufacturer. All goods are shipped U.P.S. only. Add 2% of price, or minimum of $3.00 for shipping. Shipping charges on Printers & Accessories vary. We do not ship C.O.D. Please allow one to two weeks for personal or corporate checks to clear. To expedite shipping send money order, certified cashier's check, or charge to your **VISA, MasterCard, WE DO NOT Add a Service Charge For Credit Card Usage.** Prices subject to change without notice. NOT RESPONSIBLE FOR TYPOGRAPHICAL ERRORS.

Hardware, software, and other developments for the PC.



IBM Quietwriter

HARDWARE

IBM has introduced two new letter-quality printers. **Quietwriter** uses a new print technology that electronically "paints" ink onto the paper using a special resistive ribbon, electronic type fonts, and an electronic printhead. The printhead, which contains 40 tiny electrodes, releases a current that generates pinpoints of heat in the ribbon. The ribbon releases its ink in response to the heat. The printer operates at 40 to 60 characters per second, depending on which of the four pitches is used. Automatic single-sheet feed and continuous forms feed attachments are options. The **Wheelprinter** operates at 25 cps. It has automatic cut-sheet feed as well as continuous forms feed as standard features. It uses a cartridge printwheel and operates bi-directionally in any of four pitches. Prices: Quiet-writer, $1,395; Wheelprinter, $1,795.

Also recently announced by IBM is the **PC/AT/370**, which functions as three workstations in one: a System/370 Conversational Monitor system workstation; an IBM 3278/79 display attached to a host computer; and a standard AT. The PC/AT/370 processes System/370 programs approximately 25 to 116 percent faster than the XT/370 and it processes up to 8MB of virtual storage. An optional upgrade kit allows the AT, with VM/PC 1.1, to execute many System/370 instructions. The kit includes a PC/370 processor card and 512KB PC/370 memory card. Prices: PC/AT/370, $9,795; Upgrade kit, $3,095.

IBM
900 King Street
Rye Brook, NY 10573
914/934-4825

CIRCLE 476 ON READER SERVICE CARD

Emulex Corporation has added a memory expansion board to its Persyst product line. The **PC/Short Memory board** is a four-by-five-inch board that mounts in the short expansion slot of the PC/XT or Portable to provide 384KB of add-on memory. This enables the user to achieve full memory capacity in a short-slot plug-in when used with the 256KB motherboard, leaving the long slots free for use by other functional boards. The short board will also plug into a full-size slot in the PC/AT, adding the 128KB required to realize the 640KB capacity of this unit. Board memory is available in five configurations, expandable in 64KB increments. Memory capacities of 128KB, 192KB, 256KB, and 384KB are switch-selectable. Byte parity is provided. $259 for 64KB version to $759 for the 384KB board.

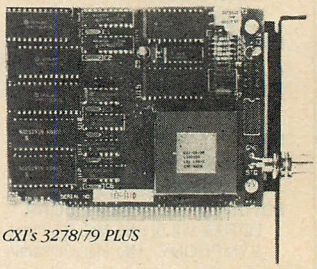
Emulex Corporation
3545 Harbor Blvd.
P.O. Box 6725
Costa Mesa, CA 92626
800/854-7112
714/662-5600 (in California)

CIRCLE 473 ON READER SERVICE CARD

CXI recently announced two 5-inch interface boards and supporting software for IBM Personal Computers. The **3279/79 PLUS PC Connections**, available either as a coaxial connection or as a modem connection, perform full 3278/79 emulation as well as some 3270 PC capabilities, enabling a personal computer to access 3270 applications on a host computer and concurrently run standard PC applications software. The newest member of CXI's Connectware family, the 2178/79 PLUS is available as a coaxial connection for attachment to IBM cluster controllers as a modem connection for remote attachment emulating an IBM 3274. The windowing function of the CXI 3278/79 PLUS allows the user to simultaneously view a host session, a PC-DOS session, and two note pads. Control is from a standard IBM PC keyboard. Information from the host and PC sessions can be combined in the note pads in any manner, allowing the user to generate personalized reports. Both products, $1,145. A software upgrade for existing CXI PCOX or 3278/79 Coaxial Connection customers is available for $145.

CXI, Inc.
3606 West Bayshore Road
Palo Alto, CA 94303-4229
415/424-0700

CIRCLE 469 ON READER SERVICE CARD

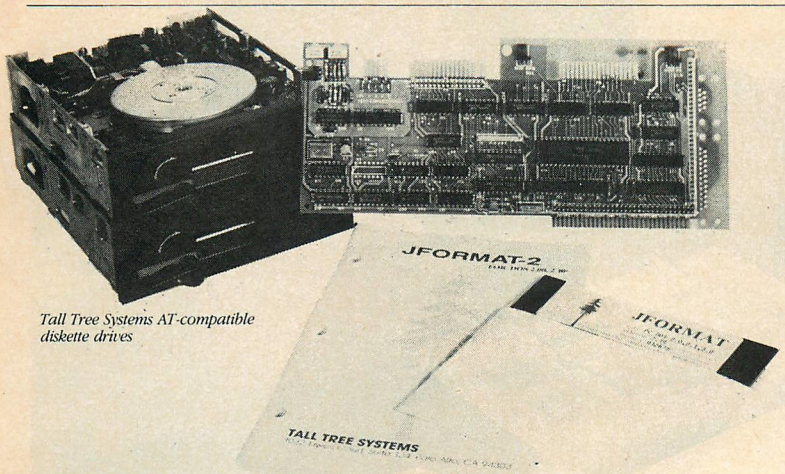


CXI's 3278/79 PLUS

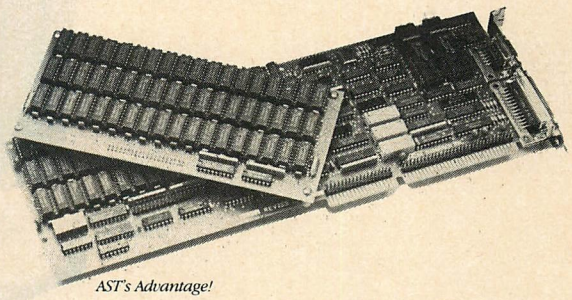
Digital Communications Associates' 911 is a full-duplex dial-up modem designed for use in a two-wire general switched telephone network. This modem operates at speeds of 1,200 bps or 2,400 bps, complying with CCITT V.22 bis, V.22, and BELL 212A standards. The 911 has automatic calling and answering functions through the RS-232 interface and also has an integrated line monitoring speaker. $1,195.

Digital Communications Associates
303 Technology Park
Norcross, GA 30092
404/448-1400

CIRCLE 467 ON READER SERVICE CARD



Tall Tree Systems AT-compatible diskette drives



AST's Advantage!

Tall Tree Systems has announced a hardware and software package that puts 1.2MB IBM PC/AT-compatible diskette drives in the IBM PC and XT. The diskettes hold more than three ordinary diskettes. The AT drive package includes a Teac 1.2MB half-height drive, a Teac 360KB half-height drive, Tall Tree Systems proprietary diskette controller that supports up to four drives, a mounting bracket, and software to format, read, and write 1.2MB drives. The package is also available with one 1.2MB drive (no 360KB) and with two 1.2MB drives. The diskette controller can plug into a JRAM-2 memory board, putting up to two megabytes of RAM plus the diskette controller in a single slot. A boot PROM will be available soon to allow PCs to boot up from a 1.2MB drive. Two-drive package, $499.

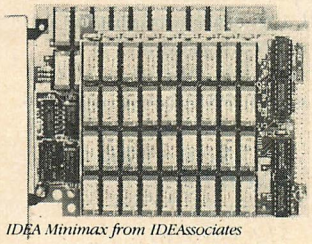
Tall Tree Systems
1032 Elwell Court
Suite 124
Palo Alto, CA 94303
415/964-1980

CIRCLE 475 ON READER SERVICE CARD

IDEA Minimax and IDEAmini are plug-in cards for the IBM Portable from **IDEAssociates**. IDEA Minimax, designed for the short slots of the Portable, offers up to 384KB RAM memory in a double-decker configuration. With 128KB on the base board plus 256KB on the override card, it takes only one slot in the PC, XT, or Portable. The IDEAmini I/O card has been redesigned to fit the Portable. The card offers a choice of two serial ports, parallel port, and clock/calendar options. It is designed with a COM3 port to link four PCs, XTs, or Portables in the IDEAshare local area network. Both the IDEAmini and the IDEA Minimax come with a library of multifunction software. IDEA Minimax, $295 with 128KB to $625 with 384KB. IDEAmini, $195 with one option to $270 with four options.

IDEAssociates
7 Oak Park Drive
Bedford, MA 01730
617/275-4430

CIRCLE 472 ON READER SERVICE CARD



IDEA Minimax from IDEAssociates

Advantage! is a multifunction expansion board from **AST** that allows IBM PC/AT users to add up to 3MB of RAM to take full advantage of the AT's high performance bus and larger memory addressing capability. The user-upgradable memory is designed to hold either standard 64KB chips or the new generation of 256KB chips. Advantage! also offers up to one IBM-compatible parallel printer port, two serial ports, and a game port. $595.

AST Research, Inc.
2121 Alton Avenue
Irvine, CA 92714
714/720-1824

CIRCLE 474 ON READER SERVICE CARD

AT Power is a multifunction expansion card that adds up to 4MB of memory to the IBM PC/AT from **Profit Systems, Inc.** Its base configuration has 128KB parity checked memory. I/O ports include both serial (switch selectable) and parallel ports as standard features and an optional second serial port and/or game port. $495.

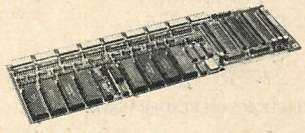
Profit Systems, Inc.
4655 Old Ironsides Drive,
Suite 400
Santa Clara, CA 95050
408/748-9551

CIRCLE 471 ON READER SERVICE CARD

Digigraphic Systems Corporation has announced a multichannel communication board that runs on the PC/AT, PC/XT, and compatibles. The **COM-8** fits into an expansion slot in a microcomputer chassis, adding eight individually addressable serial ports to the IBM and compatibles. COM-8 boards can be chained together to enable a system to support as many terminals as the microcomputer's memory capacity and operating system will allow. Prices: COM-8, $629; COM-4, which adds four individually addressable serial ports to the AT, XT, and compatible machines, $309.

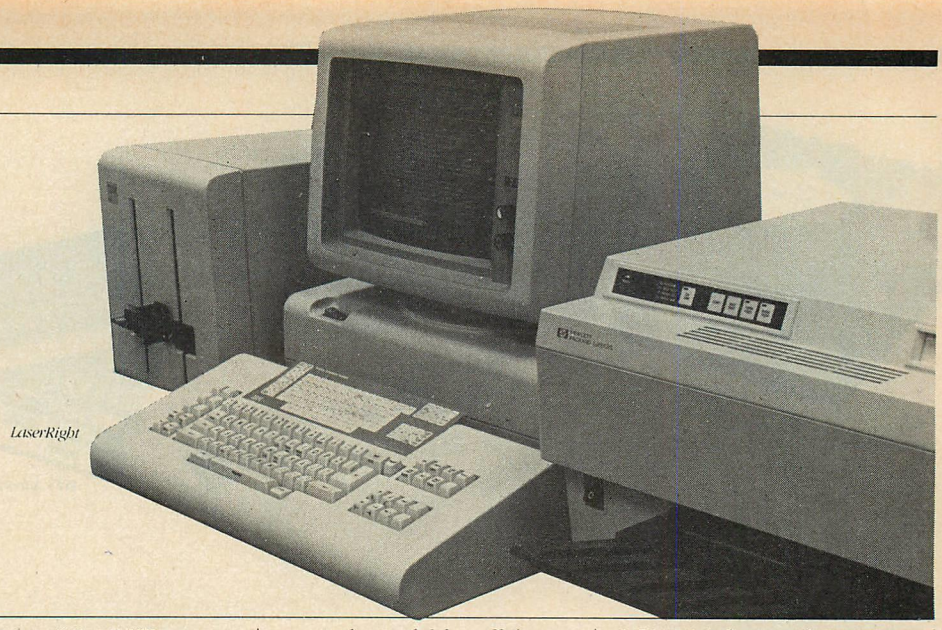
Digigraphic Systems
10273 Yellow Circle Drive
Minnetonka, MN 55343
612/935-9111

CIRCLE 470 ON READER SERVICE CARD



COM-8 from Digigraphics

The new **HAL PCI-2000** is a plug-in card for the PC that interfaces the computer to a shortwave radio for copying radio-teleprinter and Morse code signals. Signals that could be copied include news services and amateur radio communications. The PCI-2000, by **HAL Communications Corp.**, can also transmit Morse and teleprinter signals in applications that would require two-way radio communications. The unit includes 300 baud ("103 type") modem tone sets for both half- and full-duplex operation and a 1200 baud ("202 type") half-duplex tone set. An external FCC-approved DAA isolation device (Bell CDT or equivalent) is

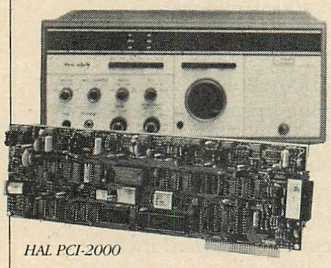


LaserRight

required for connection to the telephone line. The PCI-EXT optional Connector Expander separates the various lines on the PCI-2000's DB-25 connector for easy phono-cable connections to the radio and other equipment. The PCI-2000 comes with an advanced split-screen terminal operating system on disk. PCI-2000, $595; PCI-EXT connector expander, $49.

HAL Communications Corporation
P. O. Box 365
Urbana, IL 61801
217/367-7373

CIRCLE 465 ON READER SERVICE CARD



HAL PCI-2000

Extended Systems has announced two new models to its **LaserRight** professional workstation printing family. The **ESI-2513** and **ESI-2517** intelligently support a laser printer on up to three PCs. A special included driver allows IBM's DisplayWrite 2 text-processing package to be used, as well as other standard applications software packages. The two new models have cluster controllers that occupy only one option slot in one PC, PC/XT, or PC/AT. ESI-2513 accepts input from the host PC and from external parallel output ports (Centronics type) from up to two external PCs. Once accepted, the inputs are converted to a serial format while, at the same time, buffering the data for the laser printer. ESI-2517's output buffering capabilities are the same as ESI-2513's; however, ESI-2517's cluster controller accepts input from the host PC and from external serial output ports of up to two external PCs. Each LaserRight comes with a laser printer, cluster controller, cabling, diagnostic hardware, DisplayWrite 2 driver, spooler software, documentation, and consumable starter kit. LaserRight, $4,695 (call the company for options and pricing).

Extended Systems
6062 Morris Hill Lane
P. O. Box 4937
Boise, ID 83711
208/322-7163

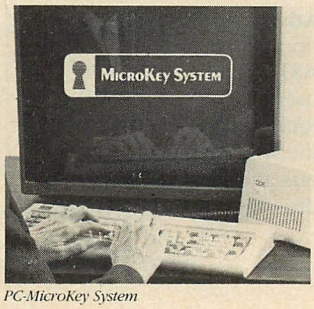
CIRCLE 463 ON READER SERVICE CARD

Video Associates Labs, Inc. has announced a new plug-in circuit board for the PC that allows the overlay of computer-generated text and graphics on any incoming video source. **PC-MicroKey System** is offered at two distinct product levels. Without special programming, any currently available, off-the-shelf software for the PC can be used to combine the realism of video with the flexibility of computer-generated text and graphics in a simultaneous display.

Level I is a low-cost, RGB-only system designed for use with video disc players equipped with external sync. The monitor required is the Sony KX series or its equivalent. Level II offers the added feature of broadcast-quality NTSC composite video output to the RGB capability of the Level I system. The PC-MicroKey System Level II allows the flexibility of overlaying not only the output of any video disc player, but also any video tape player, still-frame video tape, or camera. Under Level II, this combined display can be broadcasted and recorded. PC-MicroKey System Level I, $900; Level II, $1,805.

Video Associates Labs, Inc.
3933 Steck Avenue
Suite B-106
Austin, TX 78759
512/346-5781

CIRCLE 464 ON READER SERVICE CARD



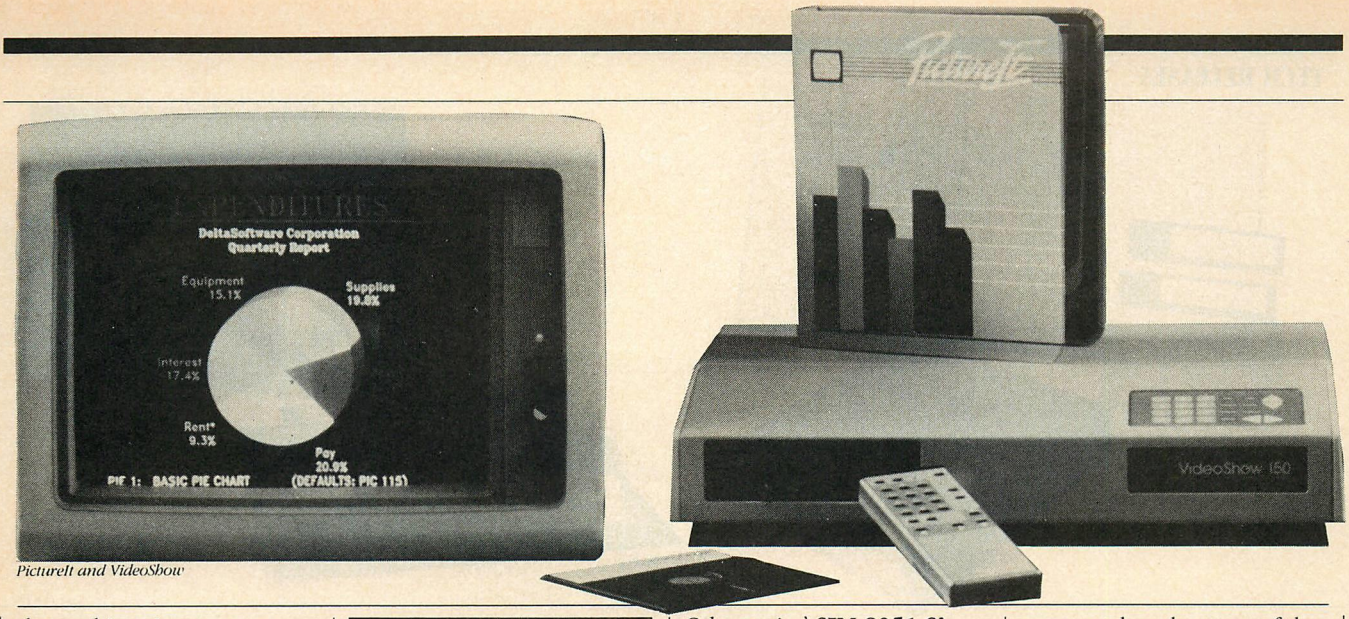
PC-MicroKey System

AQUIX Advanced Systems, manufacturer of the high capacity Network Data Systems AQMS 513, and **Gateway Communications**, manufacturer of the G/NET Local Area Network, are combining efforts to provide a high capacity, high performance local area network system for the IBM PC and compatibles. The **AQMS 513-G/NET LAN** combination provides a complete office automation network solution comprised of networking, large mass-storage, streaming tape back-up and built-in security. The combination will be available through the participating outlets of both Aquix and Gateway. AQMS 513, $28,000.

AQUIX Advanced Systems
140 Adams Blvd.
Farmingdale, NY 11735
516/293-7810

CIRCLE 468 ON READER SERVICE CARD

General Parametrics Corporation has introduced two new video display products, **VideoShow** and **PictureIt**. The two make up a business presentation system that produces high-quality graphic images in 1,000 colors that can be displayed on any color television, color monitor, or video projector. The presentations are created on a personal computer, so they can be customized and



PictureIt and VideoShow

changed in minutes at no cost. VideoShow's wide color range and its slide-like clarity are due to MacroVision, a new display technology that uses microdots instead of pixels. This enables the graphics display to have up to 1,000 colors in any picture and a 1/2000 horizontal positioning accuracy (HPA) as opposed to the maximum 16 colors and a 1/640 HPA in systems previously available.

Using the PictureIt software on any PC or compatible, the businessperson prepares a presentation on diskette. Twenty-five different bar, line, pie, and word chart formats can be combined and modified to produce an almost infinite variety of business graphics. The PC is used only for creating the graphics—not for giving a presentation. Instead, the diskette is inserted into VideoShow, the 16-pound portable hardware; VideoShow is then connected to any color display, and the presenter uses a handheld, wireless remote control to direct the presentation. VideoShow, $3,499; PictureIt software, $595.

General Parametrics Corporation
1505 Solano Avenue
Berkeley, CA 94707
415/459-4003

CIRCLE 466 ON READER SERVICE CARD

SOFTWARE

The **IBM Personal Computer Software Support Center**, which provides technical assistance on IBM PC software products, has been expanded and is now available on an annual subscription basis. The center began as a pilot program is January 1984. Its services now include technical assistance on 35 PC software programs and a monthly newsletter with tips and techniques, information on new products, and in-depth technical articles. For the annual membership fee, subscribers receive the newsletter and may call the center on a fee basis for information about using a program's features and functions, as well as in-depth assistance with programming and technical aspects of the product. The center operates from 10 a.m. to 6 p.m. EST. The annual membership fee is $40; subscribers pay $40 for one or more telephone calls on a specific question.

IBM Corporation
Entry Systems Division
P. O. Box 1328
Boca Raton, FL 33432
800/426-2700

CIRCLE 461 ON READER SERVICE CARD

dBUG 88, a new software debugger from **Cybernetic Micro Systems**, executes 8086/88 object code on the PC, PC/XT, and compatibles. Cybernetics' **SIM 8051 Simulator/debugger** executes 8051/52 object code (read from Intel Hex format files) on the PC and compatibles. The single-letter commands used to control the debugger and the simulator, combined with the multiwindow display of processor state, give the user unprecedented, interactive, dynamic control over the program that is being debugged. dBUG 88 allows the user to step through and track everything he wants to see, to determine where the program is incorrect. dBUG 88, $195; SIM 8051 Simulator/debugger, $395.

Cybernetic Micro Systems
P. O. Box 3000
San Gregorio, CA 94074
415/726-3000

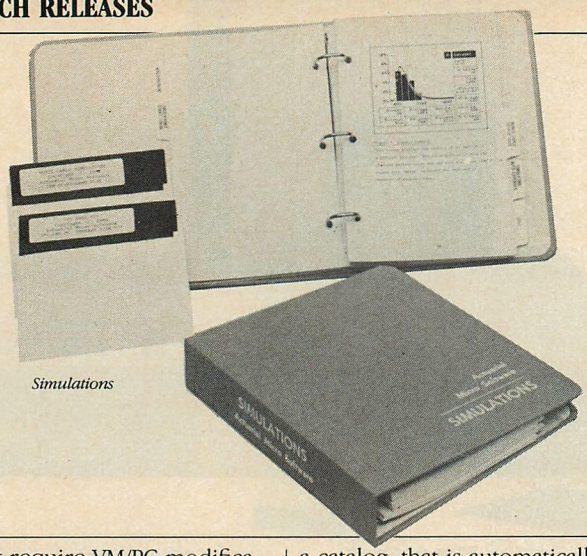
CIRCLE 460 ON READER SERVICE CARD

B&L Computer Consultants has released three new products: **MULTI-JOB** is a software package that allows up to nine PC-DOS-compatible programs to be running at the same time. It supports PC-DOS 2.0, 2.1, and 3.0. **AT DOS** is an extension to the PC-DOS operating system that allows the user to run programs under the real mode using standard PC-DOS or under the protected mode of the 80286 processor. Running programs under the protected mode enables the user to take advantage of the vast memory addressing capabilities; programs under the protected mode can use up to 16MB of actual memory or 1 gigabyte of virtual memory. **SMARTWIRE** is a low-cost LAN for the PC, PC/XT, and PC/AT. In the SMARTWIRE environment, each user can have additional disk drives and character devices, such as printers, that are actually on another machine. At the highest level, the new devices are DOS drivers and standard DOS devices; programs can be loaded from a remote machine as if they were local. The SMARTWIRE OEM package comes with a low-level driver that uses a standard communications port. MULTI-JOB, $159 (demo copy, $25); AT DOS, object code licenses begin at $5,000, source code licenses begin at $20,000; SMARTWIRE, $5,000. (OEM package)

B&L Computer Consultants
7337 Northview, Suite B
Boise, ID 83704
208/377-8088

CIRCLE 459 ON READER SERVICE CARD

Tym/VSAM, a program recently released by **InfoTym**, provides critical VSAM support for PC/XT users. The system supports processing for programs written in PL/1, COBOL, and assembly languages. Index information and data are stored in a single CMS file under the program's management. It does



Simulations

Bakup

not require VM/PC modification, so a program can be tested at the same workstation where it was developed. Tym/VSAM is also an effective tool for mainframe users. Programs can be developed on the PC/XT, sent to the mainframe, then run with the mainframe version. Tym/VSAM for PC/XT, $395; Tym/VSAM for mainframes, $5,000 (for a limited time).

InfoTym
Tym/VSAM Marketing
20705 Valley Green Drive
Cupertino, CA 95014
800/325-1551
314/232-4910 (collect from Canada)

CIRCLE 458 ON READER SERVICE CARD

InfoTools, Inc. has announced **Bakup**, a high-speed, intelligent program to back up and restore any or all of the files on a fixed disk on the PC/XT, PC/AT and compatibles. Bakup speeds, automates, and manages the back-up process; creates a database of back-up information; simplifies the retrieval of backed-up data; and prints a variety of reports, among other things. According to InfoTools, the key to Bakup's speed and convenience is the intelligence built into the package. Where a streaming tape device copies every disk track onto tape, Bakup copies only changed files onto the output. Another unique feature of Bakup is its database of back-up information called a catalog, that is automatically created during the back-up process; the program supports a number of restoration choices. Bakup also features a convenient back-up/restore time and diskette forecast, a reporting module, a disaster recovery mode, color support, and context-sensitive help screens. $149.95, plus $5.00 shipping and handling.

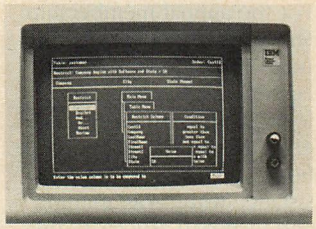
InfoTools, Inc.
1138 Pomeroy Avenue
Santa Clara, CA 95051
800/538-8157, ext. 801
800/672-3470 ext. 801 (in California)

CIRCLE 462 ON READER SERVICE CARD

SoftCraft, Inc. has released a new database management tool product that provides a fast, easy-to-use method for building database queries. **Xtrieve**, developed for the PC, is a data dictionary that provides a virtual table interface to data files, allowing users to quickly retrieve information from the database. Xtrieve is menu-driven and allows a user to define any virtual table consisting of data from one or more files, then use a full range of restriction criteria to query the data. Xtrieve is available in a LAN version, allowing multiple workstations to access the same files simultaneously. Xtrieve is available for MultiLink, PCnet, NetWare, OmniNet, and EtherSeries LANs. Xtrieve is based on Btrieve, a file management and record retrieval system that uses the b-tree file management structure; it also provides a DIF interface and other interfaces that allow it to transfer information between existing Lotus 1-2-3 and dBASE II files. Xtrieve, $195; Xtrieve network version, $395.

SoftCraft, Inc.
P. O. Box 9802
#590
Austin, TX 78766
512/346-8380

CIRCLE 451 ON READER SERVICE CARD



Xtrieve

Actuarial Micro Software has announced **Simulations** for the PC. Simulations is a statistical software package that allows the user to analyze past experience and explore future possibilities. The package includes the General Application Simulation System (GASS) and Monte Carlo Simulations. GASS simulates up to 10 variables simultaneously and combines them into one user-defined algorithm; using GASS, almost any statistical model can be constructed and its risks quantified. Monte Carlo Simulations incorporates statistical analysis and simulation capabilities. The Chi-Square Goodness of Fit Test is used to match a set of raw data to a standard distribution. Monte Carlo Simulations also acts as a front-end to GASS by analyzing past experience, and can enhance GASS results with additional graphics and reports. Simulations package, $395 (demo package, $50); GASS (separately), $325; Monte Carlo Simulations (separately); $125.

Actuarial Micro Software
3915 A Valley Court
Winston-Salem, NC 27106
719/765-5588

CIRCLE 452 ON READER SERVICE CARD

QCAD SYSTEMS, INC. has announced **QPARSER SYSTEM**, an LR(1) parser generator complete with sample compilers and a free copy of Turbo Pascal. QPARSER takes a grammar and generates a correct, complete, high-performance compiler in Pascal, although it is adaptable to other languages. The generated source code includes a lexical analyzer, and a symbol table and semantics manager. $1,995.

QCAD SYSTEMS, INC.
1164 Hyde Avenue
San Jose, CA 95129
800/538-9787
408/255-5574 (in California)

CIRCLE 457 ON READER SERVICE CARD

101 Hands-on Micro Software Evaluations. Yours for just $19 each!

The only way to really see what a software package can do is to try it out. But software evaluations take time—and money. And even then you can't be sure you didn't overlook something big.

That's why thousands of corporate micro software buyers are turning to Data Decisions for accurate, up-to-the-minute information and independent hands-on analysis.

Data Decisions gives you the results of tests done under *consistent, controlled conditions* by a specially trained team of micro experts who tell you what each product's strengths and limitations are and how suitable it is for corporate use. They also give you all the pricing and specs.

> "Just one report saved me three nights of tinkering at a computer store on my own time. It's like having a consultant sitting right there at the end of the desk."
>
> —Bob Butler, Mechanical Engineer
> Gillette Company, Boston, MA

Until recently these evaluations were available only to subscribers to MICROCOMPUTERS, Data Decisions' 3-volume monthly updated information service. Now you can receive some of the same reports our subscribers get for only $19 each, just by filling out and returning the order form below. If you include payment with your order, you'll avoid a shipping charge.

Data Decisions
20 Brace Road • Cherry Hill
New Jersey 08034 • (609) 429-7100

Data Decisions **20 Brace Road**
Cherry Hill, New Jersey 08034 • (609) 429-7100

Spreadsheets, Finance and Planning
__ EQ Business Planning Tool
__ ER CalcIT
__ ES CalcStar
__ ET Intecalc
__ EW Multiplan
__ EX Peachcalc
__ EY Perfect Calc
__ EZ SuperCalc-3
__ FA TK!Solver
__ FB VisiCalc
__ FC Visi On Calc
__ FD VisiSchedule

Data Management
__ FE Advanced DB Master
__ FF Benchmark Data Manager
__ FG Btrieve
__ FH C.I.P.
__ FJ Dataease
__ DM DataStar
__ FL Day One DBMS
__ DJ dBASE II
__ FN dBASE III
__ FO DBM II—The Integrator
__ FP Domus Correspondence Control Manager
__ FQ Fast Facts
__ FR Friday!
__ FS Instant Recall
__ FT KeepIT
__ FW Knowledge Manager
__ FX Metafile
__ FY Nutshell
__ FZ Omnifile
__ GA Perfect Filer
__ GB Personal Pearl
__ GC pfs:File
__ GD pfs:Report
__ GE Power-Base
__ GF ProBase
__ GG R:Base Series 4000
__ DN ReportStar
__ GJ Revelation
__ DK T.I.M. IV
__ GL Under Control
__ GM Versaform XL
__ DO VisiFile

Word Processing
__ GO Benchmark
__ GP Easywriter II
__ GQ Finalword
__ GR Megawriter
__ GS Multimate
__ GT New Word
__ GW Office Writer
__ GX Palantir Word Processor
__ GY Peachtext
__ GZ Perfect Writer
__ HA pfs:Write
__ HB Select
__ HC Spellbinder
__ HD Superwriter
__ HE Textra
__ HF VisiWord
__ HG Volkswriter Deluxe
__ HH Word
__ HJ Samna Word II
__ HK Wordperfect
__ HL WordStar

Graphics
__ HM BPS Business Graphics
__ HN Chart Master
__ HO dGRAPH
__ HP Fast Graph
__ HQ Graphics Department
__ HR Graftalk
__ HS PC-Draw
__ HT Peachtree Business Graphics System
__ HW pfs:Graph
__ HX Visi On Graph

Communications
__ HY BLAST
__ HZ Crosstalk
__ JA Data Capture
__ JB IBM Asynchronous Communications Support
__ JC PC/Intercomm
__ JD PC-TALK III
__ JE Perfect Link
__ JF Smartcom II
__ JG The APPLE-IBM Connection
__ JH VisiLink

Integrated Packages
__ EJ AURA
__ JK Context MBA
__ JL ENCORE!
__ EF Framework
__ EG Goldengate
__ DL Lotus 1-2-3
__ EH PC/Focus
__ JQ SeriesOnePlus
__ EI Symphony
__ JS III E-Z Pieces

Utilities
__ JT Colortext
__ JW DESQ
__ JX Norton Utilities
__ JY Oneshot
__ JZ Prokey
__ KA Quickcode

Total Quantity Ordered ..... _____

Total Cost for Reports ($19 ea.) ..... $ _____

$2 Shipping/Handling per Report ..... $ _____

Total (Sales tax will be added on invoice where applicable) ..... $ _____

Signature _____

Name _____ Title _____

Company _____ Telephone _____ (area code)

Address _____

City _____ State _____ Zip _____

A120

CIRCLE NO. 209 ON READER SERVICE CARD

TECH BOOK

A Special Section for Product and Service Listings

Accessories/Supplies

IBM STYLE BINDERS, SLIPS

Complete program packaging line. D-ring cloth binders, slip cases, floppy pages, game portfolios. Continuous paper with three large holes, 20 lb. to go in binders. Blank disk envelopes. Function key cards tell user your F1-F10 meanings. Call, write for prices. Catalog. Fast service, low prices

ANTHROPOMORPHIC SYSTEMS LIMITED
376 E. St. Charles Road
Lomobard, IL 60148
(312) 629-5160

Computer/Insurance

INSURE YOUR COMPUTER

Our small computer policy covers your hardware, software & supplies against almost any physical loss or damage. Limited personal liability too. Business use is permitted. Available in most areas. Competitive rates. For more information & application contact.

COMPUSURANCE, INC.

COMPUSURANCE, INC.
PO Box 561952, Dept PCT
Miami, FL 33256-1952
(305) 665-6617

Hardware/Add-on Boards

FIXED DISK BIOS/BOOT

fiXT boots from DATAMAC, DAVONG, XEBEC, PERCOM, GREAT LAKES, ZOBEX, others. Adds XT-like BIOS interface for your disk to IBM PC or COMPAQ. Plug-in installation. DOS 2.0/3.2/reqd. Specify controller model with order $70 + $3 shpg. + tax. MC/VISA (optional volume support at additional cost.)

GOLDEN BOW SYSTEMS
P.O. Box 3039
San Diego, CA 92103
(619) 298-9349

DT2801 SERIES ANALOG I/O

Plug-in data acquisition boards with 8DI/16SE analog inputs, high or low level programmable gains, 2 analog outputs, 16 lines of digital I/O, DMA, on-board clock, and on-board microprocessor. Optional software subroutines and screw terminal panels.

DATA TRANSLATION INC.
100 Locke Drive
Marlboro, MA 01752
(617) 481-3700

TOTAL PC&XT INPUT/OUTPUT

ESE introduces two extremely powerful communications adapters for the PC&XT & compatibles. One is a unique multi-interrupt RS-232 serial add-on for one OR MORE users; $139.50, and the second is a programmable 24 line parallel interface; $119.45. Both have ESE's full 64K selectable I/O address decoders.

ELECTRONIC SYSTEMS ENGINEERING
477 Congress Street, Suite 911
Portland, Maine 04104
MC/VISA (207) 773-7778

"MULTIFONT"

A NEW ADD-ON CARD FOR THE IBM PC/XT. "MULTIFONT" ENABLES THE IBM MONOCHROME PRINTER ADAPTER TO HAVE 256 USER DEFINABLE SYMBOLS. IT COMES WITH A POWERFUL CHARACTER/SYMBOL EDITOR, A PRINTING UTILITY, AND TEN ALREADY-MADE FONTS, INCLUDING APL, HEBREW, ARABIC, SCIENTIFIC, AND ELECTRONIC SYMBOLS. "MULTIFONT" IS TOTALLY TRANSPARENT TO THE SOFTWARE AND WORKS WITH ANY WORD PROCESSORS. LIST PRICE $249.95 HASH TECH CO., 2065 MARTIN AVE, #103, SANTA CLARA, CA 95050, (408) 988-2646.

INDUSTRIAL I/O

A full line of industrial I/O cards including RS-422, Four Port RS-232, and Combo Parallel/Serial Interface. Connect your PC to programmable controllers, data acquisition, keyboards, terminals, relay modules, or ADAMS NEW RS-422 REMOTE LCD-KEYBOARD MACHINE CONTROLLER. Other monitoring and control products available.

adams

ADAMS INC.
PO Box 17525
Greenville, SC 29606
(803) 297-9630

Hardware Communications

"VOICE I/O FOR THE IBM PC" Talk back to your PC! Add voice I/O to your application with a DIALOG sound digitizer board. Features include phone interface, tone decoding, modem. High fidelity, low data rate. We provide device drivers, demos, code examples, HLL link ('C", Pascal, and BASIC), manual, OEM support. Call for more details.

DIALOGIC

DIALOGIC CORPORATION
164 McKinley Avenue
East Hanover, NJ 07936
(201) 386-0202

Hardware/Disk Drives

1.2MB PC-AT DISK DRIVES

Replace your PC disk controller and full-height disk drive with our JDISKETTE controller plus our 1.2MB and 360k half-height drives for $499. Only $375 without 360K drive, $549 with two 1.2 MB drives. Put 800K on ordinary diskettes. 1.2MB diskettes are $59 per box (10). Mounting brackets, and JFORMAT included. Jdiskette also plugs into our JRAM-2 multifunction board.

TALL TREE SYSTEMS

TALL TREE SYSTEMS
1032 Elwell Court, Suite 124
Palo Alto, CA 94303
(415) 964-1980

Hardware/Monitors

PC DISPLAY TESTER

The pocket sized Montest-PC provides on-site testing of mono-chrome and color PC monitors. It permits individual testing of all three colors and video intensification. Attached to the display by a 9-pin D. The presence of a vertical bar, with an intensifiable right half, indicates a working monitor. $129.95.

NETWORK TECHNOLOGIES INCORPORATED
Box 203
Chagrin Falls, Ohio 44022
(216) 543-1646

Mailing Lists

IBM MAILING LISTS

Over 100,000 names of IBM personal computer owners (counts increase daily) available for rental on labels or magnetic tape. Total 600,000 including other brands. Plus IBM + compatible retail store + 50 other lists. Call or write for free catalog.

IRV BRECHNER
TARGETED MARKETING, INC.
Box 5125
Ridgewood, NJ 07451
(201) 445-7196

Software/Accounting

SOURCE CODE INCLUDED

Fully integrated innovative accounting, order processing, inventory, and sales analysis software. Available for a one time charge. Resell as often as you wish. NO ROYALTY PAYMENTS EVER! Written in C BASIC, in use since 1981 and over 1000 installed. Professional packaging and point of sale material available at cost. Includes 700 pages of documentation, Master Disks, and 10 sets of sales literature for $995.00.

TECHNOLOGY GROUP
2000 L Street N/W Suite 200
Washington, DC 20036
(416) 826-5320

Software/Business

TIME TRACK

Is a time recording and billing system that converts time spent by people within an organization into invoiced amounts. The system is menu driven for ease of operation. Online help screens supplement an extensive user guide. The license price of TIME TRACK is $495.00.

DOMUS Software Limited
251 Cooper Street
Ottawa, Canada K2P 0G2
1 (613) 230-6285

IBM PC DATA ENTRY SYSTEM

The MARK 1 System allows fast and accurate Data Entry within a Job/Batch environment. The system includes: Entry, Verify, Search, Field Totals, Password Security, Field Edits, Custom Screen/Form Design, Comprehensive HELP Facility, Menu Driven and Much More. Files can be exported to PC DOS format for additional processing by the PC or for file transfer to other mini or mainframe computers. Runs on: PC, XT & AT. $295.

SUNUS SYSTEMS, INC.
4244 Ridge Lea Rd., Suite 25
Amherst, NY 14226
(716) 834-2820

RATES AND INFORMATION

Listings are grouped by category and consist of a bold lead line (23 characters maximum), 7 lines of ad copy (45 characters per line), plus 4 lines of company name, address and telephone number.

Listings are available only on a 3 issue basis at $90. per issue ($270. total). Copy will have a set format and remain the same for all 3 months. Enhance the appearance of your ad by including your Logo and an additional cost of $25. per issue ($75. minimum extra charge). Pre-payment is required by check, money order, or American Express, Diners Club, MasterCard, Visa credit cards. Closing Date: 1st of 2nd month preceding cover date.

Send copy and remittance to PC TECH JOURNAL, TECH BOOK, 12th FLOOR, 1 PARK AVENUE, NEW YORK, NY 10016. Call (212) 503-4506 for additional information or assistance.

TECH BOOK

DATA SECURITY—$49.95

Secure sensitive data with DES FAST-CRYPT, an efficient Assembly language version of the powerful Data Encryption Standard algorithm. Encrypt/Decrypt any file at 120,000 bytes/min. Program or BASIC/PASCAL callable subroutines UNPROTECTED DISK w/manual—$49.95. VISA+MC OK. For IBM-PC, XT + compatibles 64K any PC/MS-DOS.
KIWI SOFTWARE CO.
P.O. Box 218 T
Plainsboro, NJ 08536
(718) 816-1873

SOFTWARE/BUSINESS OPPORTUNITIES

SOFTWARE AUTHORS

WE WILL CONNECT YOU TO MAJOR SOFTWARE PUBLISHERS FREE. We are in contact with many publishers looking for marketable software. If you have a quality software package or program and wish to have it published and distributed, contact:
SOFTSEARCH, Inc.
P.O. Box 281
Budd Lake, NJ 07828
(201) 627-1790

SOFTWARE/COMPILER

DESMET C—$109

Full K&R C compiler, assembler, linker, librarian, full-screen editor and example software. Both 8087 and floating point libraries. OUTSTANDING PRICE/PERFORMANCE. Rated 1st or 2nd in August '83 BYTE benchmarks. No royalties on generated code. C Ware newsletter. Unlimited updates at $20 each. PC-DOS (Ver 1.1 & 2.0), generic MS-DOS and CP/M-86 support. $109 for complete package, shipping included. Now available with source level debugger. Price $159.

C WARE CORPORATION

C WARE CORPORATION—MAIL ORDER DEPT.
P.O. Box 710097
San Jose, CA 95171-0097

WIZARD C COMPILER

The power of C with the thorough diagnostics of PASCAL. Full LINT diagnostic integrated with compiler. Full UNIX SYSTEM 3 compatibility. Floating point library; fast compact code; 1 register variable. In-line assembly code. UNIX emulation library. Uses MICRO-SOFT linker. PC/MS DOS 2.0 only. $450.00.
WIZARD SYSTEMS SOFTWARE
11 Willow Court
Arlington, MA 02174
(617) 641-2379

C SOFTWARE DEVELOPMENT

- Full C Compiler per K&R
  Inline 8087 or Assembler Floating Point
  Full 1 Mb Addressing for Code or Data
- MS DOS 1.1/2.0 Library Support
  Program Chaining Using Exec
  Environment Available to Main
- c-window™ C Source Code Debugger

COMBINED PACKAGE $199
c-systems
P.O. Box 3253
Fullerton, CA 92634
(714) 637-5362

SPARRY BASIC—B COMPILER

Powerful basic compiler that means business.
* Instructions support internal ISAM files.
* Four virtual screens, recall time <1 second.
* Use of all memory for basic programs.
* 13 significant digit integer math package.
* Demos with tutorial and reference manual. Price $159. Quantity discounts VISA/MC/CHECK. Mass. res. + 5% tax req. PC DOS with 128K.
SPARRY SOFTWARE LABS
PO Box 632 #A
Milford, MA 01757
(617) 473-5435

150 C FUNCTIONS $49.95

Functions, macros, assembly functions. Screen, cursor, keyboard, string, timing, BIOS and DOS, system status/control, utilities, random num. Many more you don't have but need! Just one may save five times cost of package! Get it in addition to/instead of any other library. 2 disks, all source code only $49.95. More to come: windows, screen mgr, graphics, execute.

Entelekon
SOFTWARE SYSTEMS

Entelekon
12118 Kimberly
Houston, TX 77024
(713) 468-4412

SOFTWARE DEVELOPMENT TOOLS.

THE FORMS DESIGNER™

Attention IBM Pascal, FORTRAN users! Save time in designing formatted screen I/O. Interactive Forms Editor allows you to draw lines and boxes, define fields, and edit text. Access forms or read keyboard entry by writing only one line of code. Provides sequential data retrieval and storage. Requires 128K RAM. Only $275 complete. Demo and manual $35. Call or write:
BIT SOFTWARE
PO Box 619
Milipitas, CA 95035
(408) 262-1054

SOFTWARE PERFORMANCE PROFILER

THE PROFILER™ will tell you where your program is spending it's time and allows you to do performance tuning on your code. Works with any language, data printed in histogram form. Easy to use and interpret. Complete user manual provided. Requires DOS 2.0 or better and 64K. $175.00 VISA/MC OK.
DWB ASSOCIATES
PO BOX 5777
BEAVERTON, OREGON 97006
(503) 629-9645

CBTREE for C PROGRAMMERS

Provides enhanced file access function calls directly into C programs. Maintains balanced B-trees, supports unlimited number of data records, keys, data files & key lengths. Dynamic memory allocation. Fast, Flexible, efficient. Object modules avail. or major C compilers. No royalties; Source code separate. $179.
MICRO COMPUTING SERVICES
2009 Hileman Road
Falls Church, VA 22043
(703) 893-0118

COBOL SUBROUTINES

Over 20 routines that give IBM & Microsoft Cobol: use of all keys, Ctrl, Alt, Home, End, Ins Del, PgUp, Pgdn cursor, 40 function keys, etc. Rename/delete files. Get/change default drive, video mode, file mode. Get disk free space and volume id. Make/change/remove directories. much more. Only $75. Chk or M.O.
SUN*SOFT
P.O. Box 4277
Ft. Lauderdale, FL 33338
(305) 523-0686

PC PROGRAMMING TOOLS

Structured BASIC with macros. Unlimited multiline conditionals. Labeled procedures/subroutines. Conditional macros. Structured language eliminates the line #'s. Works with interpreter and compiler. Full Professional Programming Environment (PPE) package $49.95. Demo $12.50. VISA/MASTERCARD.
BENDORF ASSOCIATES
6006 S. Main St., P.O. Box 5910
Rosewell, NM 88201
(505) 347-5701

OPTIMIZE YOUR CODE !!

The CODE SIFTER isolates CPU intensive areas of your code. Optimize the bottlenecks and your program will execute much faster. Use with any EXE created by DOS LINK—any source language. EASY to use—for both novices and experts. 30 day money back guarantee. Call or write for details. IBM PC 64K+ DOS 2.+ $180.
DAVID SMITH SOFTWARE
Box 25A RD #3
Oxford, NY 13830
(607) 843-6209

MATIS, The Screen Manager

70 Assembler subroutines used as BASIC commands, PROCEDURES in PASCAL, and CALLS in C and Assembler. Features: window management, easy screen design, control and saving to disk, printer utility, demo program. 170-page manual included. $150. CA add 6.5%. $2.50 shipping. No Royalty.
SOFTWAY
500 Sutter Street, Suite 222
San Francisco, CA 94102
(415) 397-4666

C-INDEX+

C-INDEX+ provides complete data management for C language applicatioins development.
- B+ Tree ISAM Indexing
- Variable Length Data Storage
- Full Data Integrity Protection
- High Performance and Flexibility
- Complete Source Code
- No Application Royalties

Fully supports Lattice and C86 compilers in large and small models. Available from Trio Systems and leading software retailers. One-time License Fee: $400. Demonstration: $25.
TRIO SYSTEMS
2210 Wilshire Blvd. Suite 289
Santa Monica, CA 90403
(213) 394-0796

TOOLS FOR TURBO PASCAL 40+ DEVELOPMENT SUBROUTINES

Including Debugging and Tuning Aids
SNAP HEX DUMP SORT
SET FKEY CMNDS DATE/TIME/DOW
ELAPSED TIMER SECTOR 1/D
PC DOS 2.0 TURBO PASCAL 2.0 Source incl. Send $29.95 check/MC/VISA (TX pay $31.78)
ALLEN, EMERSON & FRANKLIN
PO BOX 928
Katy, TX 77449
(713) 391-8570

PROGRAM DEVELOPMENT ENVIRONMENT FOR BASIC

A full screen editor designed for the BASIC language. Automatic update of line numbers for all edit functions. Group move, copy, delete. Global search, replace. Programmable keyboard, macros, undefined line number check, much more. SINGLE KEY SWITCH BETWEEN THE EDITOR AND BASIC INTERPRETER. Program is directly transferred from the editor to BASIC's workspace and back. Single key invocation of IBM BASIC compiler. Requires IBM-PC or XT, DOS 1.1 thru 2.1, 192k. $39.95 Money back guarantee.
JACKSON SOFTWARE
1729 Mayflower Drive
Carrollton, TX 75007

TECH BOOK

See AN EDITOR BEST BUY!

See is for programmers. Fastest screens. Fastest load & ready. Easy to learn with On-Screen help, tutorial. 20 active file-windows 256 ch. lines. Char, line, block & file do undo operations. Auto-indent, Wildcard search-replace. No file size limits. Invoke DOS, run a program, return as was. Full-features. Need: PC, jr, XT or AT; 128K; DOS 2.0+. Inquire UNIX version. $69.50 demo $12.50.
PROLOGIC CORPORATION
31324 Via Colinas, Suite 111
Westlake Village, CA 91362
MC/VISA (818) 991-5062

ASSEMBLE 3-6 TIMES FASTER

FAST ASSEM-86 is much faster and easier to use than the IBM Assembler. Assembles 8K files 6 times faster. Editor, assembler and source always in RAM so you can go instantly from editing to assembling. No need to LINK since produces .COM (as well as .OBJ) files directly. Source compatible with IBM's important features. Supports 186, 286, 8087, 287 directly. X-ref. utility built in. Only $199.
SPEEDWARE
Box T1, 2931 Northrop Avenue
Sacramento, CA 95825
(916) 966-6247

RAPID COMPILER DESIGN

An LR(1) parser generator complete with sample compilers. QPARSER creates a parser, a lexical analyzer and skeleton semantics with universal error recovery & interactive debugging. Adaptable to other languages. Runs on IBM PC. Textbook available in 1985. Educational/quantity discounts. FREE BROCHURE.
$1995. from QCAD SYSTEMS, INC.
P.O. Box 700129, 1164 Hyde Ave.
San Jose, CA 95129
TOLL FREE (800) 538-9787; (408) 255-5574 in CA

2/3D TOOLS for DeSmet C

Create dynamic symbol and image displays with a high performance graphics toolkit. FAST; to 290K pixels a sec., TIGHT; 6K. COMPLETE; invoke line, block, pattern, clip, text, windows, popups hi-res, color, and loon, Editor on PC, XT, AT color card. Order, call or write for more info. $55.
AFFINITY INC.
126 Normal Ave.
Buffalo, NY 14213
(716) 882-5077

THE HAMMER—tools in C

More than just BOLD/DOS access, THE HAMMER ALSO provides screen attribute control, Smart modem-control, UNIX-like pattern matching, 123-like command menus, easy data entry & verification of dates, numbers and string AND MORE. Routines tried & true. $110.00 with source. Call or write now:
OES SYSTEMS
1906 Brushcliff Road
Pittsburgh, PA 15221
(412) 244-1086

SOFTWARE/ENGINEERING

PC ENHANCEMENT HANDBOOK

THE IBM PC ENHANCEMENT HANDBOOK for SCIENTISTS & ENGINEERS. A How-To-Handbook with answers to all of your questions on PC enhancement. What can be done? How to do it? and How much will it cost? Includes Toll Free Hotline for application assistance & convenient one stop shopping. SPECIAL INTRODUCTORY OFFER $18.95.
CyberResearch, Inc.
P.O. Box 9565
New Haven, CT 06536
(800) 341-2525; (203) 436-2600 (CT)

smARTWORK™

Printed-circuit artwork editor for double-sided boards up to 10" by 16", runs on an IBM-PC. Color display allows complete interactive control over the placement and routing process. 2X artwork can be made on a dot-matrix printer or pen-and-ink plotter, $895. Write or call for a brochure.

WINTEK

WINTEK Corporation
1801 South Street
Lafayette, IN 47904-2993
(317) 742-8428

STRUCTURAL FABRICATORS

PC/Cutlist takes input from your bill of material—Detail drawing and calculates the best cutting combination for any length stock and prints a shop ready cutting list and scrap report. Also an optimization feature finds best mult length for mill orders. Demo Disk $25.00.
THE JOSEPH ALBERT CO.
P.O. Box 611
Blue Island, Illinois 60406
(312) 349-9032

SOFTWARE/FILE MANAGEMENT

FILE HONEY

No more memorizing subdirectory names, waiting for "Dir" or "Tree" commands, or fumbling to identify files. This directory-scanning aid uses windows for rapid access to your subdirectory tree; allows scrolling of sorted file directories; and much more. For PC/XT with 128K & DOS 2.0. Price $42.50—demo $5.00.
JOE PHILLIPS CO.
9071 Metcalf, Suite 145-C
Shawnee Mission, KS 66212

A FRIENDLY FILER

There has NEVER been a filing program easier to use than SeekEasy. NEVER! It uses an advanced "flexible match" algorithm. Just type APPROXIMATELY what you want to find seeking easy does the rest. Fast! PC/MS-DOS 2.0. $87 (demo $15)—add 6.5% in CA. Add $3 S&H. VISA/MC O.K. Free brochure & reviews.
CORRELATION SYSTEMS
81 Rockinghorse Road
Rancho Palos Verdes, CA 90274
(213) 833-3462

SOFTWARE GENERAL

RENT PUBLIC DOMAIN SOFT/W

Rent our PC Disk Libraries for 7 days and copy them yourself. Hundreds of useful business, games and utilities FREE FOR THE TAKING!

IBM-PC SIG-135 Disks	$135.00
IBM-PC "Blue" 53 Disks	$50.00

Rental is for 7 days after receipt, 3 days grace to return. Most credit cards accepted.
NATIONAL PUBLIC DOMAIN
SOFTWARE CENTER
1533 Avohill Drive
Vista, CA 92083
(619) 941-0925. Info-(619) 727-1015. 24 hr. orders.

AMWAY DISTRIBUTOR PROGRAM

REQ: Disc Drive, Color Card, 64K, 80 Column mon, basic. Processes orders to Epson, Prowriter & Okidata pntrs plain or SA-1 forms. Easy Menu Driven Operation. Tracks PV, BV, Inventory Per Bonus, etc. 400 STK# Info File. Handy Year to Date File for Tax Purposes. Lots More!!! Saves Time. $69 + tx. Send Chk or MO/WRITE:
KEYSTROKE SOFTWARE
4715 Hacienda Avenue
Campbell, California 95008
(408) 866-1351

ATTENTION SOFTWARE AUTHORS

Our established literary agency is seeking to represent talented freelance programmers. We open doors for our clients at the leading software houses and negotiate the best deal possible. Put our years of experience to work for you. For further information on the benefits of representation contact:
THE ROBERT JACOB AGENCY
1642 Eveningside Drive, Suite 110
Thousand Oaks, CA 91362
(805) 492-3597

SOFTWARE/GRAPHICS

GEOGRAF™

GEOGRAF™ helps you prepare high-quality, customized graphs for business, engineering and science. GEOGRAPH™ cuts programming time by up to 80%. Callable from BASIC, FORTRAN or PASCAL. Versions available for most graphics cards and plotters. Fully compatible with Colcomp's FORTRAN standard plotting package.
GEOCOMP CORPORATION
342 Sudbury Road
Concord, MA 01742
(617) 369-8304

PRESS 'N' PLOT 2.0

Insert images into your text for correspondence that counts. Capture screen images from most graphics programs and merge them with text from most word processors. Can automatically wrap the text around the image. Supports most popular color or B-W dot matrix printers. $149.
AMERICAN PROGRAMMERS GUILD, LTD.
55 Mill Plain 17-5
Danbury, CT 06811
(800) 828-8088; in CT, (203) 794-0396

TEKTRONIX 4010 EMULATION

High resolution screen/printer graphics for the IBM PC. Full interactive capabilities with file transfer and cross-hair control. Utilizes PLOT 10, protocols. OFF-line review of graphics output. Supports IBM color/graphic or Hercules cards. Easy to use 4010 emulation at an affordable price. $80.00. Demo disk $5.
Technological Systems Group
5044 Haley Court
Lilburn, GA 30247
(404) 923-4980

3D STEREO GRAPHICS $98

Stereoscopic three-dimensional wireframe plots of any x, y, z-data. If for COMPUTER AIDED DESIGN or data display, your IBM PC with color monitor will plot in true 3D, you see it with red and blue glasses. Rotate, zoom in and print it with EPSON, IBM, IDS Printer or Tektronix 4695.
3D GRAPHICS
12028 Venice Blvd., Suite 4
Los Angeles, CA 90066
(213) 206-6557

SOFTWARE/LANGUAGES

COMPATIBLE LANGUAGES

C, Pascal and Multi-basic compilers generate compatible object code so languages can be mixed. C is full K&R, Pascal is full Jensen & Wirth + extensions and Multi-Basic compiles both MBASIC and CBASIC. $139 each. Available for PCDOS, MSDOS, CPM80; TRSDOS on Models I, II, III, 4, 12. Send for free brochures.
ALCOR SYSTEMS
13534 Preston Rd., Suite 365
Dallas, Texas 75240
(214) 494-1316

TECH BOOK

SNOBOL4+
Mainframe SNOBOL4 on your desktop, plus binary and random-access I/O, SAVE files, & more! Unexcelled pattern-matching and string manipulation, integer & real math, link to assembly language. Includes ELIZA and over 100 sample programs and functions. 128K to 448K, DOS or CP/M-86. Only $95 + $3 shipping.
CATSPAW, INC.
P.O. Box 1123
Salida, CO 81201
(303) 539-3884

Software/Operating Systems

MULTIPLE USERS UNDER PC DOS
MultiLink turns PC-DOS into an efficient multi-user multi-tasking operating system. Additional users are supported by attaching inexpensive CRT terminals or modems to serial ports on the PC, and can run normal applications designed for PC-DOS. Includes host communications software for public dial-in.
THE SOFTWARE LINK INCORPORATED
6700 23B Roswell Rd.
Atlanta, GA 30328
(404) 255-1254

Software/Programming

W-ED, a small, fast and efficient editor/word-processor can be embedded into BASICA, compiled BASIC, IBM assembler, and selected C and Pascal language programs on the PC, At, jr., and compatibles. File paths and windowing are supported. Programmable version(s)—$140/ea. Stand-alone—$40. Demo $6. Brochure. MC/VISA
WyndhamWare
PO Box 729
Renton, WA 98057-0729

Software/Security

SECURITY
THE KEY™ is a hardware device used to protect software from being pirated. No special diskettes needed. End-user is free to make as many back-up copies as needed. Protects software copied to hard-disk. Standard and High Security Versions available. 100qt/$60 ea.
STAFF Computer Technology Corp.
10457-J Roselle Street
San Diego, CA 92121
(619) 453-0303

Software/Sort

OPT-TECH SORT/MERGE
Extremely fast Sort/Merge program for the IBM-PC. Can sort or merge multiple files containing fixed or variable length records. Run as a DOS command or call as a subroutine, plus many other features. Now also sorts dBASE II files! Compare before you buy any other. Write or call for more info. $99.
OPT-TECH DATA PROCESSING
P.O. Box 2167
Humble, TX 77347
(713) 454-7428

INTERNAL SORT FOR BASIC
NSORT—A FAST & easy to use quicksort subroutine written in C & assembler, CALLable from BASIC. Sorts an unlimited number of records in memory on up to 8 keys of mixed type, ascending/descending. Like having a SORT built into the language. Works w/compatibles, Compiled and Interpreted, all DOS versions. $49.95 + $2.50 s&h. MC/VISA/CHECK. PA + 6% tax.
NATIONAL SOFTWORKS
65 East Elizabeth Avenue
Bethlehem, PA 18018
(215) 867-4800

Software/Services

TAPE TO DISK CONVERSIONS
Convert any 9 track magnetic tape to or from over 200 formats including 3½", 5¼", 8" disk formats and word processors. Formats available include IBM-PC, Apple, Altos, TRS 80 8" CP/M, Displayer., IBM Sys/??. Macintosh, Wang, Lanier, OS/6 and 200 more. Disk to Disk conversions also avail. Call for more info.
PIVAR COMPUTING SERVICES, INC.
47 W. Dundee Rd.
Wheeling, IL 60090
(312) 459-6010

Software/Taxes

MULTIPLAN TAX TEMPLATES
Computes the LOWEST POSSIBLE TAX & saves time and frustration. 24 forms and schedules-in an IRS-acceptable format. Fast, modifiable and expandable. Use all year, Annual updates (or update yourself). Requires Multiplan. $79 + $4.50 S/H. Multiplan, $159: BOTH $229. We have other products. MC/VISA. ORDER NOW!
VISION INFORMATION PRODUCTS, INC.
5500 Atherton Street, Suite 306
Long Beach, CA 90815
(213) 431-5284

Software/Terminal

BLUELYNX
Replace your dumb terminals with smart PCs and XTs. TECHLAND SYSTEMS is the nation's leading synchronous communications company with over 6,000 BLUELYNX' installed. The BLUE-LYNX hardware/software product emulates the 5251/12 for the S/34, S/36 and S/38. Now bundled with Autolynx for unattended operation ... only $745. BLUELYNX 3276 for the larger 43xx and 30xx mainframes, both SDLC and BSC versions, now comes bundled with Data Reader, a utility that facilitates the formatting of host files into Lotus 1-2-3, dBase, etc. ... only $795. Printer and up-and-download support available with both versions.

TECHLAND SYSTEMS INC.

TECHLAND SYSTEMS, INC.
25 Waterside Plaza
New York, NY 10010
(212) 684-7788

Software/Terminal Emulation

VT52/VT100/TEKTRONIX 4010
ZAP emulates the above terminals and includes nested environment files, XMODEM & Kermit file transfer, auto-redial, key bindings, integrated text & graphics, save/restore graphics utility and dump mode. XON/XOFF. Create variable-size graphics characters. Requires DOS 128K. $65+ $5 shipping (PA residents add 6%)

CHESHIRE CAT SOFTWARE
PO Box S
Devon, PA 19333
(215) 644-4914

Software/Typesetting

HIGH-TECH TYPESETTING
Transmit your text via toll-free lines directly to our fully automated typesetting system. $2. per K characters with a $5. minimum. Same day service. 200 typefaces in sizes up to 72 point. Send $15. + $3. shipping for our 220 page guidebook, or call toll free and use your MC, VISA or AMEX.
INTERGRAPHICS INC.
106A South Columbus Street
Alexandria, VA 22314
(800) 368-3342 or (703) 683-9414 in DC area.

Software/Utilities

TOOLS FOR PROGRAMMERS
• FILE TOOL KIT. COMPARE lists file differences, COMPRESS shrinks files, ENCRYPT secures valuable data, HEXDUMP lists files in hex and ASCII.
• PASCAL TOOLKIT. PXREF prints program cross-references; PNEAT prettyprints programs. PCASE highlights variables. Just $29.95 each, both for $49.95. VISA/MC accepted.
SEVEN VALLEYS SOFTWARE
P.O. Box 99
Glen Rock, PA 17327
(717) 235-5470

COPY PROTECTION
SLK/F places an assembled or compiled program on a diskette with 4 different copy-resistant features in such a way that it runs normally, but cannot be copied by backup programs such as COPYPC. The rest of the diskette is available as normal, and DOS may be added. Price $150.

OLIVE BRANCH SOFTWARE

OLIVE BRANCH SOFTWARE
1715 Olive Street
Santa Barbara, CA 93101
(805) 569-1682

DOS PATH COMMAND FOR DATA
Now Lotus 1-2-3, dBASE II, WordStar and most others can access data files no matter where they are located! Works with hard disks and floppies. DPATH is a system stay-resident function that allows you to organize your disk any way you like. Includes a screen-oriented maintenance utility & a 60-page manual. DOS 2.0/compat. $25.
PERSONAL BUSINESS SOLUTIONS INC.
PO BOX 757
Frederick, MD 21701
(301) 865-3376

TECH BOOK

DISK MECHANIC

THE ULTIMATE Floppy Disk Backup & Repair Utility. Can back up ALL software protected disks written on the IBM PC. Works manually or automatically. Files or sectors can be restored, searched, examined & changed. Checks disk drive speed. req. IBM PC, DOS 1.1 (128K)/2 (192K) + 64K if only 1 floppy drive. $73 ppd. USA

MLI MICROSYSTEMS
PO BOX 825, Dept. TB
Framingham, MA 01701 USA
(617) 926-2055 for info MC/VISA

CopyWrite

CopyWrite backs up IBM PC software. We have not found anything that we can't copy. CopyWrite is revised monthly to keep up with the latest in copy protection, and comes with a trade-in offer. It needs an IBM PC, 128K and one disk drive, but can use more memory or another drive. $50 US. Check/Credit Cards. U.S. Inquiries.

QUAID SOFTWARE LIMITED
45 Charles St. East
6th Flr.
Toronto, Ontario M5Y 1F2 Canada

CONVERTS ANY CPM TO DOS

CROSSDATA CONVERTS ANY DATA/TEXT FILE format from CPMxx to MS/PC-DOS, CPMxx to CPMxx & MS/PC-DOS to CPMxx. Cross data runs on IBM PC or comparable computer using MS/DOS 2.0. Cross data is a self-contained program. It comes with over 24 mats and user can add own format. To order send $99. check or money order to:

AWARD SOFTWARE, INC.

AWARD SOFTWARE, INC.
236 North Santa Cruz Ave.
Los Gatos, CA 95030
(408) 395-2773

A FRIEND FOR TURBO PASCAL

PASCAL'S FRIEND is four include files giving easy BIOS/DOS access with examples plus easier use of Blaise Tools/MS Pascal code, keyboard, cursor, and screen handling, inverse video, system clock, calendar calculations, 1-2-3 like menu routines. Source for example program. $39.95 check, MO, Visa, MC.

J.S. COMPUTING
434 N. Lumber St.
Allentown, PA 18102
(215) 821-9020

END DISK INCOMPATIBILITY

with CONVERT—the critically acclaimed disk/conversion program. CONVERT runs on the IBM/PC and compatibles. It reads, writes and FORMATS diskettes for over 40 different CP/M computers. CONVERT is the standard disk conversion software. Buy the best for only $99. VISA/MC accepted.

SELFWARE, INC.
3545 Chain Bridge Rd., Suite 3
Fairfax, VA 22030
(800) 242-4355

Hard Disk DIRECT ACCESS™

The ULTIMATE utility for any hard disk user. DIRECT ACCESS is a powerful hard disk management tool. Organizes your software programs into a "user defined" menu system. Features attractive screen display, rapid access into an application using a single keystroke & easy to learn. Also handles batch files & complicated DOS commands. Order today. Only $59.95 + $2.50 shipping & handling. MC/VISA.

DELTA TECHNOLOGY

DELTA TECHNOLOGY
P.O. Box 1104
Eau Claire, Wisconsin 54702
(715) 832-0958

PADLOCK/PADLOCK II DISKS

PADLOCK furnishes the user with a method for providing protection against unauthorized duplication from DOS commands $99. PADLOCK II disks come preformatted with finger-print and serialization. PADLOCK II disks offer superior protection. Ask about our fast data encryption product. All work with hard disk, EXE/COM files and all DOS versions. MC/VISA.

GLENCO ENGINEERING
3920 Ridge Ave.
Arlington Hts., IL 60004
(312) 392-2492

FULL CONTROL FROM BASIC

Cut development time, add speed & power to your programs w/NLIB. A library of assembly language subroutines callable from BASIC: execute COM & EXE files, save & restore areas of the screen, clear & scroll windows, much more! Add DOS functions to your menus. Create fast help screens. Unlimited uses. All DOS Versions $49.95 + $2.50 s&h. MC/VISA/CHECK. PA + 6% tax.

NATIONAL SOFTWORKS
65 East Elizabeth Ave.
Bethlehem, PA 18018
(215) 867-4800

SCREEN DESIGN MADE EASY!

Screen Generator and Processor for BASIC programmers. This package combines a Screen Painter for creating and modifying screens and Macro Language and Compiler for quicker coding and testing. Features COLOR, field variables, complete input editing, line drawing. For BASIC, BASICA, and BASIC Compiler users. Includes manual and reference card. $99.95 VISA/MC accepted.

BasicWindow™

G. FREEMAN & COMPANY, INC.
15 Albin Road
Stamford, CT 06902
(203) 327-9868

USE YOUR PRINTER! $39.95

DIGICON PRINT PACKAGE for IBM/Epson printers

LAYOUT —Print sideways. Section pages for brochures, booklets. Select size and style of characters (up to 35/inch)

SET UP —Easy setup of printer features such as italics compressed emphasized

EDITCHAR —Create or modify character sets interactively (20 + sets included!)

All with menus of single line input. Complete on-line help! DOS, 128K. Check or M.O. (PA 6%).

DIGITAL CONCEPTS
PO Box 8345, Dept. A
Pittsburgh, PA 15218
(412) 823-8314

SS/MS/IBM FORTRAN USERS

Utility subroutines that includes DOS/BIOS gates, cursor, screen, inkey, free read of text or numbers with function key control, output scrolling, line and window clear, capset, numlock, music, draws rectangles, statistical and financial routines. $40 IBM 2.0/MS 3.2, $45 SuperSoft 1.0 or 2.0 (Demo $8 w/freeware financial program). Chk./M.O.

COMPUTER HANDHOLDERS
P.O. Box 59
Arcola, PA 19420
(215) 565-7467

WHERE ARE THEY NOW?

Have you ever forgotten which directory a file is in? The WHERE program searches through all directories for the file you ask for, displaying the path of each matching file name. WHERE is easy to use, accepts? and *, and is indispensable for clean up and reorganization. WHERE requires MS or PC DOS 2.00 and above. $20 (includes s&h).

KING PROGRAMMING PRODUCTS
P.O. Box 432
Wood Dale, IL 60191
(312) 350-0100

COPY II PC

CPY II PC backs up protected & unprotected software, with verification. Available memory is full utilized to minimize disk duplication time. Also includes a drive speed utility that can pinpoint drive problems. For IBM-PC. $39.95 + $3 s/h ($8 outside North America). Prepayment required: VISA/MC, check or money order.

CENTRAL POINT SOFTWARE, INC.
9700 SW Capitol Hwy., #100T
Portland, OR 97219
(503) 244-5782

ELIMINATE IO ERROR = 98.

If you lose time to IO ERROR = 98 in your RM/COBOL applications, VERIFILE can save you hours of restructuring time. VERIFILE is a DOS command file that detects and corrects errors in RM/COBOL ISAM files before programs are executed. Disk and reference manual included. Send check or money order for $69.96 to:

GREYSTONE GROUP, INC.
214 Second Avenue North
Nashville, TN 37201
(615) 248-9119

PC ALARM CLOCK FOR $30

STOP MISSING IMPORTANT APPOINTMENTS. PC ALARM provides an alarm function and time-of-day display for the IBM-PC/XT under DOS (1.0 or later). Initiate ALARM with times & messages, then forget it as you run other software, until ALARM signals your attention with both audible and visual displays. Mono or RGB.

LAF SOFTWARE
3 Kiowa Lane
Los Alamos, NM 87544
(505) 672-3359

PRINT SCREEN

Prints reverse video, underlining, high and low intensities and all 256 characters for IBM PC text screens. Graphic screens can be printed in a variety of sizes, vertically or horizontally. A variety of printers are supported. The license price for PRINT SCREEN is $50.00.

DOMUS SOFTWARE LIMITED
251 Cooper Street
Ottawa, Ontario K2P OG2
1-(613) 230-6285

PERSONAL CHARACTERS

Create character sets, print IBM, foreign & Greek characters, change printer modes & fonts using DOS, Alter character sets, download characters sets using DOS and BASIC programs, printer driver for microsoft "word", Epson FX-LQ-1500, or Okidata 9× printers. Minimum requirements: 128K, & DOS 2.0. MC/VISA/CHECK $49.50.

GROFAR SYSTEMS
26 W. Faculty Rd.
Thousand Oaks, CA 93160

SOFTWARE/WORD PROCESSING

VOLKSWRITER DELUXE

Features TextMerge™ for customized mailing lists; multi-lingual, engineering & scientific symbols; horizontal scrolling to 250 characters; document size 1 megabyte; on-screen page endings, underline, boldface, double-strike, strike-through, multiple fonts & colors—fewest keystrokes per function. Only $295.

LIFETREE SOFTWARE INC.
411 Pacific Street
Monterey, CA 93940-2790

TECH MART

FORTRAN
or
PASCAL
PROGRAMMER?

READ
THIS
AD

GRAPHICS
- Text/graphics generics
- 2D interactive
- 2D plots (full support) including auto-scaling, auto-axis generation, auto-labeling, tabular/log/parametric curves, splines, bars, pies, you name it, we have it.
- 3D Plots incl. 2 hidden line removal options—not just old-fashioned wire frame.

PEN PLOTS
- Standard plotter primitives plus
- FULL 2D support plus
- Interface to screen graphics,
- Limited 3D.

Clear and complete documentation.

GRAFMATIC $135.
PLOTMATIC 135.

MICROCOMPATIBLES
11443 Oak Leaf Drive
Silver Spring, MD 20901
(301) 593-0683

CIRCLE 305 ON READER SERVICE CARD

ICs PROMPT DELIVERY!!!
SAME DAY SHIPPING (USUALLY)

DYNAMIC RAM			
256K	256Kx1	150 ns	$23.47
64K	64Kx1	120 ns	4.77
64K	64Kx1	150 ns	4.27
64K	64Kx1	200 ns	4.07
16K	16Kx1	200 ns	1.21
EPROM			
27256	32Kx8	300 ns	$49.97
27128	16Kx8	300 ns	17.50
27C64	8Kx8	200 ns	22.50
2764	8Kx8	250 ns	6.50
2732	4Kx8	250 ns	6.37
2716	2Kx8	450 ns	3.50
STATIC RAM			
6264LP	8Kx8	150 ns	$31.25
6116P	2Kx8	150 ns	4.77

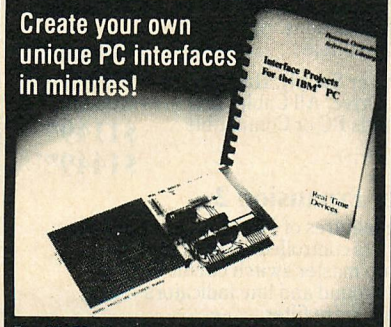
QUANTITY ONE PRICES SHOWN

Open 6½ days: We can ship via Fed-Ex on Sat.

MasterCard/VISA or UPS CASH COD
Factory New, Prime Parts µP∞
MICROPROCESSORS UNLIMITED
24,000 South Peoria Ave.
BEGGS, OK. 74421 **(918) 267-4961**

Prices shown above are for October 15, 1984
Please call for current prices & volume discount. Prices subject to change. Please expect higher prices on some parts due to world wide shortages. Shipping and insurance extra. Cash discount prices shown. Small orders received by 6 PM CST can usually be delivered to you **by the next morning, via Federal Express Standard Air @ $5.99!**

Create your own unique PC interfaces in minutes!



The PD100 allows rapid development of specialized PC interfaces. It features a buffered data bus, switch-selectable address decoder, and a large prototype area (up to 40 IC sockets). The 116-page manual covers basic interfacing concepts and details implementing A/D, D/A converters, I/O ports, connection of transducers and dozens of useful circuits.

PD100 w/manual - $99
plus $3.50 P&H
Manual only - $20 Postpaid
PA residents add 6%
Check, MasterCard, or VISA

REAL TIME DEVICES
1930 Park Forest Ave.
P.O. Box 906
State College, PA 16804
(814) 234-8087

Cables
EIA RS 232-C
Send for Catalog

Quality cables with immediate delivery and low prices.

Conductor	Price
1-4	11.50 + .15/ft.
5-7	12.00 + .22/ft.
8-12	13.00 + .30/ft.
13-16	14.00 + .40/ft.
17-25	16.00 + .50/ft.

Specify Male or female connectors, length of cable and pins to be connected. Extended Distance, Centronics (Parallel), Coaxial (RG59U, 62A/U), Dual Wang, Twin-axial, Ribbon, IBM, DEC Compatible cables and AB Switches also available.

We supply connector parts, bulk cable, tools and hardware (wall plates), for those who prefer to build their own cables.

Communication Cable Company
PO Box 600-K, Wayne, PA 19087
215-964-9404

CIRCLE 304 ON READER SERVICE CARD

RTL
Relocatable Threaded Language

RTL is a threaded language similar to FORTH but is based on a new type of threaded code called status threaded code. This new type of threaded code allows the inclusion of a number of features not normally included in threaded languages. Each word is independently relocatable. RTL allows editing of any high level word directly from RAM, eliminating the need for screens. Any word may be redefined retroactively so there is no kernel of unmodifyable words. RTL is now available for the 68000, 6809, 8086, and Z80.

RTL Programming Aids **$150**
10844 Deerwood SE
Lowell, MI 49331 **Includes all**
(616) 897-5672 **source code.**

CIRCLE 303 ON READER SERVICE CARD

ATTENTION: ENGINEERS PROGRAMMERS

PolyFORTH® II

the operating system and programming language for real-time applications involving ROBOTICS, INSTRUMENTATION, PROCESS CONTROL, GRAPHICS and more, is now available for...

IBM PC*

PolyFORTH II offers IBM PC users:
- **Unlimited control tasks**
- **Multi-user capability**
- **8087 mathematics co-processor support**
- **Reduced application development time**
- **High speed interrupt handling**

Now included at no extra cost: Extensive interactive **GRAPHICS SOFTWARE PACKAGE!** Reputed to be the fastest graphic package and the only one to run in a true multi-tasking environment , it offers point and line plotting, graphics shape primitives and interactive cursor control.

PolyFORTH II is fully supported by FORTH, Inc.'s:
- **Extensive on-line documentation**
- **Complete set of manuals**
- **Programming courses**
- **The FORTH, Inc. hot line**
- **Expert contract programming and consulting services**

From FORTH, Inc., the inventors of FORTH, serving professional programmers for over a decade.

Also available for other popular mini and micro computers.

For more information contact:

FORTH, Inc.

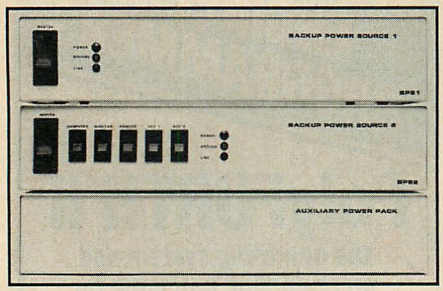
2309 Pacific Coast Hwy.
Hermosa Beach,
CA 90254
213/372-8493
RCA TELEX: 275182

Eastern Sales Office
1300 N. 17th St.
Arlington, VA 22209
703/525-7778

*IBM PC is a registered trademark of International Business Machines Corp.

CIRCLE NO. 188 ON READER SERVICE CARD

Take control of your computer.



The Backups™

Backup power for peace of mind and memory.

Backup Power Source 1

- delivers up to 225 watts @ 120V.AC
- 40 minutes of power at 50% load
- visual and audible power interrupt alarm
- fast automatic switching
  (Within 6 milliseconds of peak voltage detection)
- 2 Outlets
- AC surge suppressor
- 3 stage noise filter
- thermal output protection
- IEC power connector
- attractive metal enclosure
- 3¼″ high, 16″ wide, 11″ deep

$379.95 *complete**

Backup Power Source 2

All the features of Power Source 1 plus:

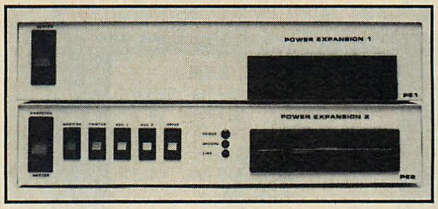
- 6 outlets controlled by front switches
- switchable visual and audible alarm
- 10 amp master switch circuit breaker
- cross suppression between all 6 outlets
- optional 2 hour auxiliary power pack

$499.95 *complete**

Auxiliary Power Pack

- 2 hours of power at full load
- plugs directly into either of our backup units
- includes 6 rechargable 12V power cells
- backup units keep power cells at full charge
- heavy duty power cable
- 3¼″ high, 16″ wide, 11″ deep

$299.95 *complete**



The Expanders™

Control power and expand with floppy or hard disks.

Power Expansion 1

- 1 stage noise filter
- AC surge suppression
- IEC power connector
- attractive metal enclosure
- 3¼″ high, 16″ wide, 11″ deep
- optional internal power supply
- optional floppy and hard disk drives

Power Expansion 1 . . . . . **$149.95***

w/Internal Power Supply **$219.95***

w/Power Supply, DS/DD Drive, All Cables and Instructions. Expands XT or Compatible **$349.95***

w/Power Supply, Half Height 10M Hard Disk Drive, All Cables and Instructions. Expands PC or Compatible . . . **$1149.95***

20M Drive **$1449.95***

Power Expansion 2

All the features of Power Expansion 1 plus:

- 6 outlets controlled by front switches
- 10 amp master switch circuit breaker
- LED ground and line indicators
- 3 stage noise filter
- cross suppression between all 6 outlets
- optional internal power supply
- optional floppy and hard disk drives

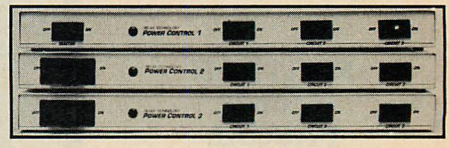
Power Expansion 2 . . . . . **$199.95***

w/Internal Power Supply **$269.95***

w/Power Supply, DS/DD Drive, All Cables and Instructions. Expands XT or Compatible **$399.95***

w/Power Supply, Half Height 10M Hard Disk Drive, All Cables and Instructions. Expands PC or Compatible . . . **$1199.95***

20M Drive **$1499.95***



The Controllers™

Control power, peripherals, spikes, and glitches.

Power Control 1

- 4 outlets control computer and 3 peripherals
- AC surge suppressor
- attractive metal enclosure
- 1¼″ high, 16″ wide, 10″ deep

$69.95 *complete**

Power Control 2

All the features of Power Control 1 plus:

- 10 amp master switch circuit breaker
- 1 stage noise filter
- IEC power connector

$89.95 *complete**

Power Control 3

All the features of Power Control 1 & 2 plus:

- illuminated switches
- 3 stage noise filter
- cross suppression between all 4 outlets

$129.95 *complete**

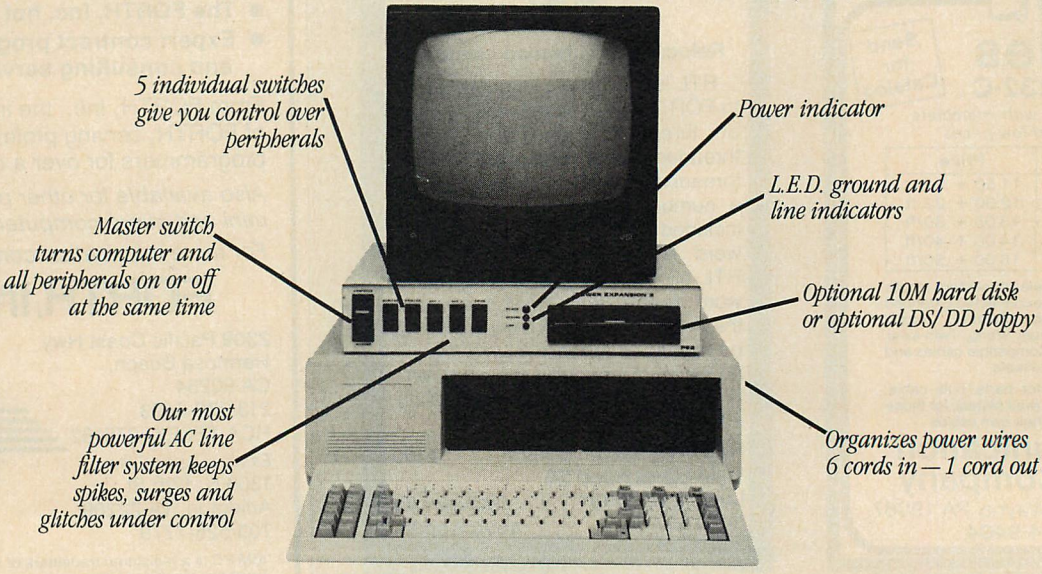
**All prices suggested retail.*

Available at fine computer stores everywhere, or by mail or phone. MasterCard and Visa accepted. *Dealer inquiries invited.*

Relax Technology

The company that works so you can relax and get down to business.

3101 Whipple Rd. #25
Union City, CA 94587
415/471-6112



CIRCLE NO. 193 ON READER SERVICE CARD

PC TECH JOURNAL PRODUCT INDEX

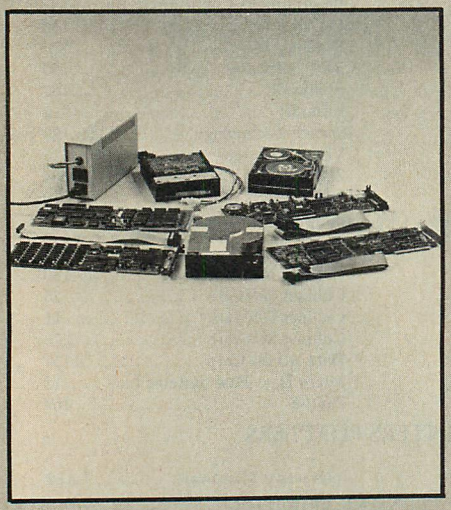
RS#	PRODUCT	ADVERTISER	PAGE #
	IBM COMPUTERS AND COMPATIBLE UNITS		
277	Expansion Chassis	I-Bus-Systems	40
152	Hardware Intro	IBM	10-11
157	51/60 and 61/60	ISI International	28
212	ITT-XTRA	ITT Information Systems	186
	ACCESSORY CARDS/MULTIFUNCTION BOARDS		
206	Memory Expansion Brd	Answer Software	172
130	SoliDISK	Fastore	53
133	Graphics Card	Hercules Computer Technology	9
127	Add-On Products	Jeden/QIC Research	206
168	Mr Chips	Orange Micro	C-4
227	PC Turbo	Orchid Technology	22
190	Quatech	Quatech	144
191	JRAM	Tall Tree Systems	39
187	Tecmar Products	Tecmar, Inc.	C-2
	NETWORKING PRODUCTS		
111	PC Slave	Alloy Computer Products	55
	OTHER ACCESSORY CARDS		
103	Advantage!	AST Research	52
180	80286 Board	Wavemate	82
	COMMUNICATION		
138	Telios	Genasys	183
142	Idea Comm	IDE Associates	30-31
160	Software	Programmer's Shop	118
239	Software	Programmer's Shop	154
171	Softerm PC	Softronics	106
	MASS STORAGE HARDWARE		
106	Hard Disk Drive	Apparat, Inc	50-51
118	Hard Disk Sub Sys.	Desert Technologies	168
134	Cartridge Tape Sys.	Digi Data Corporation	103
145	Mass Storage	Emerald Systems	167
124	9-Track Mag	IBEX Computer Corp	178
149/ 150	Disk System	Interface Inc.	151
102	Bernoulli Box	Iomega	161
237	Mega Flight 100	Kamerman Labs	24
233	PC-8000 Series	National Memory Systems Corp	173
185	9 Track Tape Backup	Overland Data, Inc	178
169	The Vision Series	Pacific Datanet, Ltd.	171
208	Mass Storage Hardware	CIA	128-129
184	Tape Backup Systems	Everex Systems	C-3
203	P-10 Series	Peachtree Peripherals	15
156	Hidey	Personal Micro Computers	102
224	Hard Disk	Qubie Distributing	37
234	Lights Out	Tall Grass Technologies	56-57
	COMMUNICATIONS HARDWARE		
117	P Cox	CXI	91
213	File Connection	Flagstaff Engineering	150
211	Quaddisk	Quadram Corporation	49
	SOFTWARE FOR PROFESSIONALS		
110	Cross Assembler	Avocet Systems Inc.	115
°	Sidekick	Borland International	135
°	Bakup	Infotools	149
155	Tax Preparation	Practical Programs	180
	WORD PROCESSING SOFTWARE		
163	Leading Edge Word Pr	Leading Edge	8
141	Text Engineer	Pelada Informatica	138
236	Word Perfect	Satellite Software Int'l	29
	LANGUAGES		
104	Gauss	Applied Technical System	178
°	Turbo Pascal	Borland International	16-17
214	Desmet	C-Ware	114
129	C-86 Compiler	Computer Innovations	112
181	C To dBase	Computer Innovations	146
222	HS/Forth	Harvard Softworks	120
243	Lisp	Integral Quality	113
186	Coherent	Mark Williams Co.	27
165	MBP Cobol	MBP Software & Sys. Tech., Inc.	188
143	Professional Pascal	Micro Tec Research	101
°	Pascal	Microsoft Inc	83
177	Better Basic	Summit Software	107-109

RS#	PRODUCT	ADVERTISER	PAGE #
	PROGRAMMER'S TOOLS		
166	Amerisoft Edit Tool	Amerisoft	136
107	PC Probe	Atron	7
115	Pascal and C Tools	Blaise Computing	41
113	C Systems C	C-Systems	154
207	SPF/PC/The Add Coupl	Command Technology Corp.	105
121	Windows for C	Creative Solutions	133
136	SIM-8049	Cybernetic Micro Systems	182
131	Debugger	D & V Systems Inc.	160
215	Periscope	Data Base Decisions	116
137	Peeks 'n Pokes	Data Base Decisions	181
216	The Profiler	DWB Associates	168
109	Microstat	Ecosoft Inc.	158
119	C-Tree	Faircom	54
105	The Greenleaf Funct.	Greenleaf Software	100
123	Modula 2	Interface Technologies	18-19
128	C-Compilers	Lattice, Inc.	157
154	V-File	Mindbank, Inc.	173
170	Lattice Window	PC Brand	86-87
161	PFIX 86	Phoenix Software Associates	81
268	Polytron Tools	Polytron	153
226	Prog. Connection	Programmers Connections, Inc.	137
158	Total Parser Generat	Q-Cad	182
162	Tall Screen	Qualitas, Inc.	170
167	Bugscreen	RDT Software	180
229	Debugger 87	Rollinsoft	182
201	B-Trieve	Softcraft	2
132	Firstime	Spruce Technology	123
221	Codesmith-86	Visual Age	26
178	Design	Zeducomp	164
192	Clipper	Nantucket	79
	DATA BASE MANAGEMENT SOFTWARE		
302	DBase 111	Ashton Tate	124-125
116	Seek Easy	Correlation Systems	180
198	Golden Gate	Cullinet Software	25
199	Golden Gate	Cullinet Software	21
200	Golden Gate	Cullinet Software	23
146	Dataflex	Data Access Corp	157
219	MDBS 111	Micro Data Base Systems Inc.	12
148	ZIM	Zanthe	164
	PRINTERS-PLOTTERS		
159	Scientific Plotter	Interactive Microware	182
	ADDITIONAL SUPPLIES		
122	Datasaver	Cuesta Systems Inc	136
220	Readiscope	Readiware	92
193	The Controller	Relax Technology	204
	LITERATURE		
209	HW/SW Information	Data Decisions	197
126	HW/SW Information	Data Decisions	162-163
202	HW/SW Directory	Data Sources	174
	SOFTWARE UTILITIES		
101	PC Firing Line	ABComputing	52
153	Multijob	B & L Computer Consultants	160
108	Visual Shell	Bourbaki, Inc.	169
112	Copy II PC	Central Point Software	166
114	Fabs & Auto Sort	Computer Control Systems	139
235	Print Boss	Connecticut Software	159
147	Library Utility	Essential Software, Inc	178
140	CIA	General Data Security	154
205	Memory Minder	J & M Systems, Ltd.	140
189	Hardrunner	Nostra Dama	93
196	Scoll & Sort	Opt Tech Data Processing	4
179	Opt Tech Sort	Opt Tech Data Processing	4
194	Copywrite	Quaid Software	158
164	File Master	Schuller & Assoc.	180
176	Matis	Softway	157
172	Screen Sculpter	The Software Bottling Co. of NY	85
	MAIL ORDER		
125		Creative Microsales	190
139		Lifeboat Assoc.	184-185
174		Microway	84
182		PC Connection	126-127
183		PC Link	191
175		Software Horizons	190
	ARTIFICIAL INTELLIGENCE		
151	Artificial Intelligence	Logic Ware	141

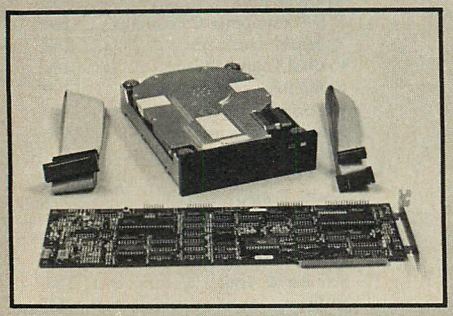
For IBM PC Add-On Products.. We Set the Standard in Prices!

Superior quality products and services at lowest prices.

Look at what we have to offer, before you buy any add-on products for your PC.

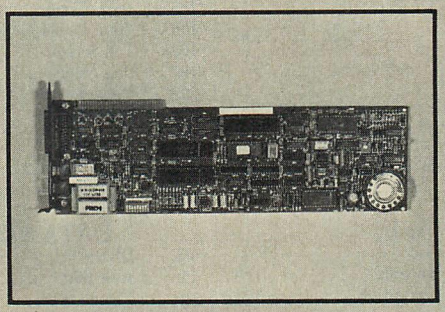


QIC-01. 10 MB internal hard disk subsystem at **$725.00.**



Our half-height 10 MB hard disk comes complete with controller, cables, drive and easy to follow instructions. It fits inside one of your floppy slots and draws same amount of current as a floppy. It is compatible with DOS 2.0, 2.1 and 3.0 without any patches. In fact, you can simply boot up from the hard disk. This is the same disk you see advertised for hundreds of dollars more.

QIC-03. 300/1200 baud internal modem. **$275.00.**



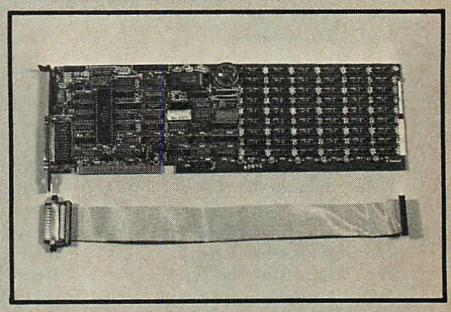
This auto dial/auto answer plug-in modem lets your PC talk to the world with reliable and easy operation. It is FCC certified, Bell 103/212 compatible as well as fully Hayes compatible. You can run all the popular communication programs as well as our superior QIC Com software program.

Our QIC-Com software program provides phone list management as well as powerful file transfer capabilities. You can even run any DOS programs such as WordStar concurrently without having to disconnect your line. Priced at $45.00, it is an offer you don't want to miss.

QIC-04. Half-height floppy. **$129.00.**

This half-height floppy is the quietest drive on the market. It draws the least amount of current and is compatible with your PC's floppy controller card. It's double sided, double density.

QIC-05. Five function card. **$199.00** (64 K RAM Set $36.00).



Our five function card includes memory expansion from 0 to 384K, one serial port, one parallel port, one game port and one battery back-up clock calendar. RAM disk, print spooler and clock utilities are included too.

QIC-06. Color/Mono display card coming soon...

One Year Guarantee

No Risk. All our products are guaranteed for one year. And remember, if for any reason, you are not completely satisfied within 30 days, you can return it for a full refund. Check out our competition and find out which is best. We know better.

CALL US TODAY AT **408-942-8086**

QIC RESEARCH INCORPORATED

528 Valley Way
Milpitas, CA 95035

CIRCLE NO. 127 ON READER SERVICE CARD

INDEX TO ADVERTISERS

Reader Service Number	Advertiser	Page
101	ABComputing	52
103	AST Research	44/45
111	Alloy Computer	55
166	Amerisoft	136
206	Answer Software	172
106	Apparat	50/51
104	Applied Technical System	178
302	Ashton Tate	124/125
107	Atron	7
110	Avocet	115
153	B&L Computer Consultants	160
115	Blaise Computing	41
*	Borland International	16/17
*	Borland International	135
108	Bourbaki, Inc.	169
117	CXI	91
113	C-Systems	154
214	C-Ware/DeSmet C	114
112	Central Point Software	166
208	CIA	128-129
207	Command Technology Corp.	105
114	Computer Control Systems	139
129	Computer Innovations	112
181	Computer Innovations	146
235	Connecticut Software	159
116	Correlation Systems	180
125	Creative Microsales	190
121	Creative Solutions	133
122	Cuesta Systems	136
198	Cullinet Software	25
199	Cullinet Software	21
200	Cullinet Software	23
136	Cybernetic Microsystems	182
131	D & V Systems	160
216	DWB	168
146	Data Access	157
137	Data Base Decisions	181
215	Data Base Decisions	116
120	Data Base Design	94-95
209	Data Decisions	197
126	Data Decision	162-163
202	Data Sources	174
118	Desert Technologies	168
134	Digi Data Corp	103
109	Ecosoft	158
145	Emerald Systems	167
147	Essential Software	178
184	Everex Systems	C-3
135	Execustat	104
119	Faircom	54
130	Fastore	53
213	Flagstaff Engineering	150
188	Forth, Inc.	203
138	Genasys	183
140	General Data Security	154
105	Greenleaf Software	100
222	Harvard Associates	120
133	Hercules Computer Technology	9
277	I-Bus Systems	40
152	IBM	10-11
142	IDE Associates	30-31
157	ISI International	28
212	ITT Information Systems	186
124	IBEX Computer Corp.	178
*	Infotools	149
243	Integral Quality	113
159	Interactive Microware	182
123	Interface Technologies	18-19
149/150	Interface, Inc.	151
102	Iomega	161
205	J&M Systems	140
127	Jeden/Qic Research	206
237	Kammerman Labs	24
128	Lattice, Inc.	157
163	Leading Edge	8
139	Lifeboat Associates	184-185
151	Logic Ware	141
165	mbp Software and Systems Technology, Inc.	188
186	Mark Williams Co.	27
219	Micro Data Base Systems	12
143	Micro Tec Research	101
204	Microstuff	35
*	Microsoft	83
174	Microway	84
154	Mindbank, Inc.	173
192	Nantucket Corp	79
233	National Memory	173
189	NostraDama	93
196	Opt-Tech Data Processing	4
179	Opt-Tech Data Processing	4
168	Orange Micro	C-4
227	Orchid Technology	22
185	Overland Data	178
170	PC Brand	86-87
182	PC Connection	126-127
183	PC Link	191
169	Pacific Datanet	171
203	Peachtree Peripherals	15
141	Pelada Informatica	138
156	Personal Micro Computer	102
161	Phoenix Software	81
268	Polytron	153
155	Practical Programs	180
226	Programmer's Connection	137
160	Programmer Shop	118
239	Programmer Shop	154
158	Q-Cad	182
211	Quadram Corporation	49
194	Quaid Software	158
162	Qualitas, Inc.	170
190	Quatech	144
224	Qubie Distributing	37
167	RDT Software	180
220	Readiware	92
193	Relax Technology	204
229	Rollinsoft	182
236	Satellite Software	29
164	Schuller and Associates	180
201	SoftCraft, Inc.	2
171	Softronics	106
172	Software Bottling Co. of New York	85
175	Software Horizons	190
176	Softway	157
132	Spruce Technology	123
177	Summit Software	107-109
234	Tall Grass Technology	56-57
191	Tall Tree Systems	39
187	Tecmar	C-2
173	Unipress Software	155
221	Visual Age	26
180	Wavemate	82
195	X-Comp	119
197	X-Comp	121
148	Zanthe	1
178	Zeducomp	164

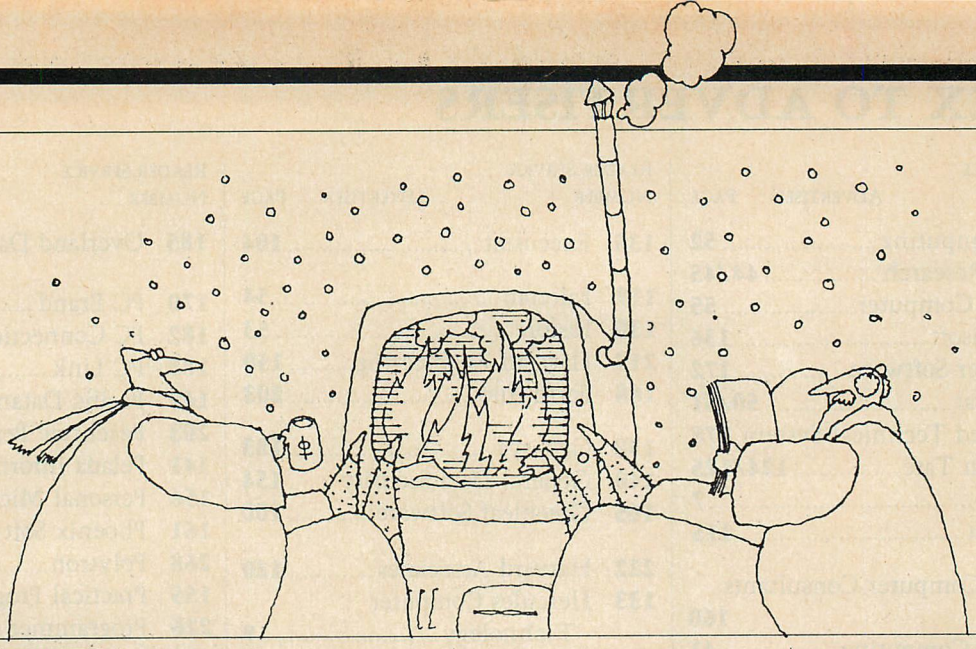


ILLUSTRATION • DAVID POVILAITIS

JANUARY

January 13-16
12th Annual ACM SIGACT-SIGPLAN Symposium on Principles of Programming Languages
New Orleans, LA
Sponsor: ACM
Contact: Brian K. Reid, Computer Systems Laboratory, ERL 444, Department of Electrical Engineering, Stanford University, Stanford, CA 94305

January 22-25
UniForum
Dallas, TX
Sponsor: /usr/group
Contact: Richard Lewis, Professional Exposition Management Company, 800/323-5155

January 23-25
USENIX
Dallas, TX
Sponsor: USENIX Association
Contact: USENIX Conference Office, P.O. Box 385, 16951 Pacific Coast Highway, Sunset Beach, CA 90742, 213/592-1381 or 3243

January 28-30
Office Automation Conference
Tucson, AZ
Sponsor: IEEE
Contact: AFIPS, 1899 Preston White Drive, Reston, VA 22091, 703/620-8900

January 28-30
ACM SIGOPS Workshop on Operating Systems in Computer Networks
Ruschlikon, Switzerland
Sponsors: ACM SIGOPS (Operating Systems) and IBM Zurich Research Laboratory
Contact: Liba Svobodova, IBM Zurich Research Laboratory, CH-8803, Ruschlikon, Switzerland

January 28-31
Communications Networks Conference & Exposition
Washington, D.C.
Contact: Bill Leitch or Nancy Hedges, CW/Conference Management Group, 800/225-4698 or 617/879-0700

FEBRUARY

February 4-6
1985 Office Automation Conference
Atlanta, GA
Sponsor: AFIPS
Contact: Trudi Riley, AFIPS, 703/620-8952

February 19-21
Computer Graphics Exhibition and Conference
London, England
Contact: World Computer Graphics Association, Inc., 2033 M Street, N.W., Suite 399, Washington, DC 20036, 202/775-9556

February 25-28
Compcon Spring '85, Technological Leverage: A Competitive Necessity
San Francisco, CA
Sponsor: IEEE-CS
Contact: Glen G. Langdon, Jr., IBM Dept. K54/282, 5600 Cottle Road, San Jose, CA 95193, 408/256-6454

MARCH

March 4-7
Interface (telecommunications)
Atlanta, GA
Contact: Amy Marks, The Interface Group, 617/449-6600

March 18-20
COMTEL-85
Dallas, TX
Contact: Michelle Robertson, International Computer and Telecommunications Conference, 214/458-7011

March 20-22
4th Annual Phoenix Conference on Computers and Communications
Phoenix, AZ
Sponsor: IEEE-CS
Contact: IEEE PCCC-85, P. O. Box 37125 C, Phoenix, AZ 85069

March 21-24
Comdex/Winter '85
Anaheim, CA
Contact: Amy Marks, The Interface Group, 617/449-6600

March 22-24
3rd Annual Maryland Computer Show & Software Exposition
Baltimore, MD
Sponsor: CompuShows
Contact: CompuShows, Inc., P.O. Box 3315, Annapolis, MD 21403, 800/368-2066

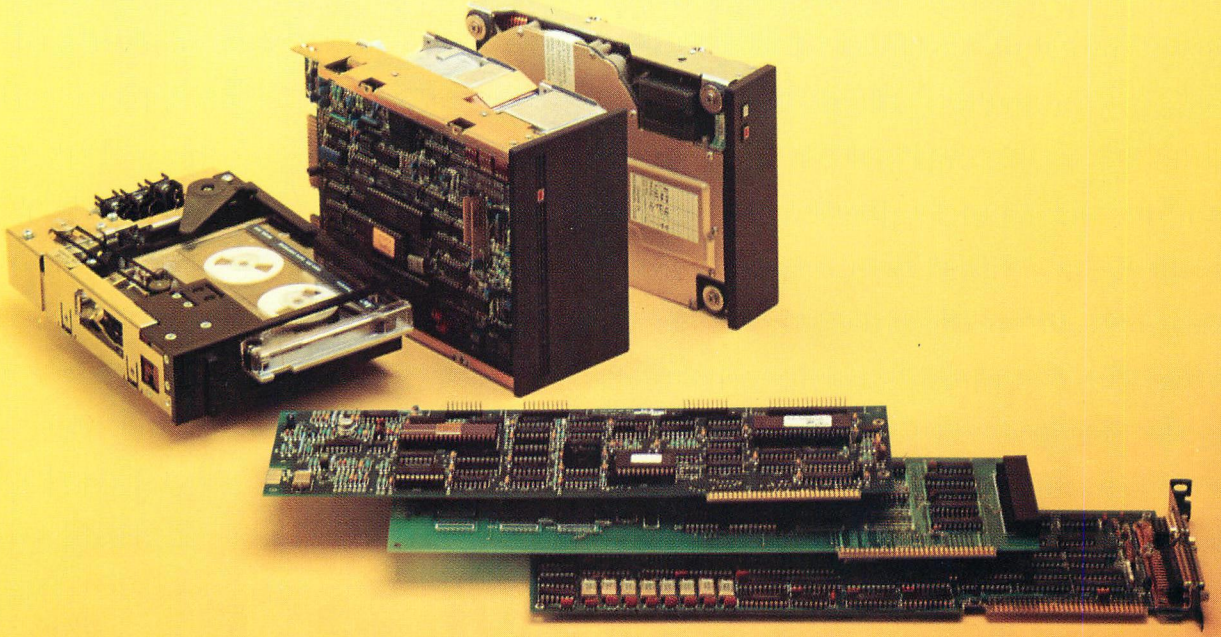
March 25-27
Fourth Symposium on Principles of Database Systems
Portland OR
Sponsors: ACM SIGACT SIGMOD
Contact: Seymour J. Ginsburg, Dept. of Computer Science, University of Southern California, University Park, Los Angeles, CA 90089-0782, 213/743-5501

March 25-28
IEEE Infocom 85
Arlington, VA
Sponsor: IEEE
Contact: IEEE Infocom 85, P.O. Box 639, Silver Springs, MD 20901, 301/589-8142

March 25-28
1985 IEEE International Conference on Robotics and Automation
St. Louis, MO
Sponsor: IEEE Council on Robotics and Automation
Contact: T. Lozano-Perez, MIT A.I. Lab, 545 Technology Square, Cambridge, MA 02139

The Innovation That Makes High Capacity Data Backup Simple and Affordable

AVAILABLE NOW!



Introducing the ***first*** high capacity 1/4-inch Streaming Tape backup systems that plug right in to your PC, XT and AT — the EXCEL series. No other backup system can match the space-saving size, high speed, and flexibility of the revolutionary EXCEL series.

Capacity To Meet Your Needs
EXCEL tape systems meet the high capacity needs of business. You can backup nearly 20,000 pages of information (up to 60 megabytes!).

Backup Information in Minutes, With the Flexibility You Want
EXCEL tape systems backup information faster than any other 1/4-inch backup system. Your ten megabyte hard disk drive can be backed up in just over *two minutes*!

You can backup two ways. For flexibility, use the file-by-file backup to select the files you want. Or, to save time, use the faster "mirror image" backup for a complete backup of your hard disk in minutes.

Here's the best part. You can backup your hard disk with a fast "image," then retrieve either file-by-file or the entire hard disk image. No other backup system lets you do this. This gives you the flexibility you want while saving you hours of time!

And EXCEL tape systems give you the largest selection of file selectable options available — choose from name, date, time, time interval, global, qualifier and more.

Choose the System That's Right For You
EXCEL tape systems are available in a wide selection of models: internal mount, external, slim, half and full sizes. Our slim-size expansion models let you add more drives or tape systems and give you more slots for adding accessories.

Visit your local Everex dealer today and ask to see the EXCEL tape system in action. You'll be amazed at how simple, flexible and affordable high capacity backup can be.

For the name of your nearest Everex dealer, call (415) 967-1111.

EVER for EXcellence

esi

Dealer Hotline (800) 821-0806. In California (800) 821-0807

Everex Systems Inc.

891 Maude Avenue, Mountain View, CA 94043

CIRCLE NO. 184 ON READER SERVICE CARD

IBM, PC, XT and AT are registered trademarks of International Business Machines Corp.
EXCEL is a trademark of Everex Systems Inc.

"Mr. Chips™ Brings Our IBM® PC To Life"

Jim Reedy, Vice President
Reedy Robotronic Productions, Inc.
Van Nuys, California

The First Multi-function Card for the Real World

At Reedy Robotronic Productions, bringing ideas to life is a way of business. With an IBM PC and Mr. Chips, the new multi-function card from Orange Micro, complex robotic machines virtually come alive.

"Mr. Chips provides the link between our IBM PC and the devices we use to develop our applications," says Jim Reedy, Vice President. "With an on-board interface that accepts direct digital timing data and a port for the measurement of variable resistive inputs, Mr. Chips allows us to program our robots to become top performers—animated characters that sing and dance in precisely synchronized sound and motion."

It's Possible Because Mr. Chips is No Ordinary Multi-Function Card. You can now open up a whole new world of applications with these innovative Mr. Chips features:

- Real World Interface*: Using an Intel® 8255 Programmable Peripheral Interface, this fully addressable twelve bit port provides an eight bit bidirectional TTL bus and four bits of programmable output.
- Dual Game Port*: Besides serving as a standard game paddle interface, this unique port also permits monitoring of four variable resistive inputs (up to 100K Ohms each) and four digital inputs. Combined with the Real World features, you can also interface your PC to many popular general purpose instruments.
- BSR™ AC Line Controller*: This interface will send coded ultrasonic signals to your BSR X-10 unit, allowing control of up to 16 AC devices. It can also be set up for responses to Real World Interface input or data from the clock/calendar to provide a complete control system.

And of course Mr. Chips also provides the features you expect on any quality multi-function card. Like memory expandable from 64K to 256K, a clock/calendar to keep track of time and date, and a parallel and serial port for communication with peripheral devices. Also included is Chipdisk™ software for configuring your PC's memory into a RAM Disk for efficient program execution and a Print Spooler for printer buffering.

These standard features provide everything you need to put your PC to work. Whether you're developing laboratory, engineering or home control applications, or even timing the beat of Barney the Bear's drum roll, Mr. Chips provides the capabilities you need at a remarkably low price. See your dealer today, or call Orange Micro for one near you. Mr. Chips, the multi-function card that puts real world power in your PC.

*Cables available separately.

Distributor/Dealer inquiries welcome

Orange Micro® inc.

1400 N. Lakeview Ave., Anaheim, CA 92807
(714) 779-2772 TELEX: 183511 CSMA

© Orange Micro, Inc., 1984
BSR is a registered trademark of the BSR Corporation
IBM is a registered trademark of International Business Machines Corporation

CIRCLE NO. 168 ON READER SERVICE CARD